Report
of the
Sanitary Measures in India
1881-82 to 1884-85

00134524

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REPORT

ON

SANITARY MEASURES IN INDIA IN 1881-2:

TOGETHER WITH

MISCELLANEOUS INFORMATION UP TO JUNE 1883.

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REPORT.

I.—EUROPEAN ARMY.

Sickness and mortality in 1881.

The health of the European Army in India during 1881 was more favourable than in either of the three preceding years. The average strength of the army during the year was 58,728; the admissions into hospital were in the ratio of 1,604 per 1,000, the daily sick 69 per 1,000, and the death-rate 16·86 per 1,000. The proportions in which the respective armies contributed to these results are shown in the following table:—

Presidency.	Average Strength.	Ratio per 1,000.		
		Admissions into Hospital.	Daily Sick.	Deaths.
Bengal*	35,901	1,729	72	17·05
Madras	10,391	1,160	60	10·97
Bombay*	9,895	1,784	72	13·44
South Afghanistan	2,541	968	72	51·55
Army of India	58,728	1,604	69	16·86

* Excluding troops in Afghanistan.

Compared with the average of the 10 years 1870–79 the admissions and mean daily sick in 1881 were higher, but the deaths were 2½ per 1,000 lower. Under all headings there was a decrease as compared with 1880, especially in the death-rate, which fell from 24·85 per 1,000 of average strength to 16·86.

Malarial fever as usual was the chief cause of sickness among the British troops, and enteric fever and cholera were the principal causes of mortality, the death-rates being 2·64 and 2·33 per 1,000 respectively.

Concerning the troops stationed in Bengal, which comprised nearly two-thirds of the entire army of India, the admission-rate, excluding troops serving in Afghanistan, fell from 1,813 per 1,000 in 1880 to 1,729, the daily sick from 75 to 72, and the mortality from 27·73 to 17·05. The death-rate also compares favourably with the two preceding decennial periods, for in the decennium 1860–69 the average death-rate was 29·98 per 1,000 or nearly 13 per 1,000 higher than in 1881, and in the decennium 1870–79 the death-rate was 21 or just 4 per 1,000 in excess of 1881. Dr. Cuningham remarks: "These data show that a very considerable reduction has been effected in the mortality "of European soldiers in the Bengal Presidency during the last twenty-two years." This decrease in mortality manifested itself throughout Bengal, and was most marked in the Gangetic Provinces and Oudh group of stations, where the mortality decreased from 29·32 per 1,000 in 1880 to 15·94. Of the six groups of stations into which Bengal is divided the Punjab group had the highest death-rate, namely, 23·44; this was also the case in the previous year when it stood as high as 36·41.

Out of the 50 stations included in the six groups of stations, Delhi and Amritsar furnished the highest rates of sickness, the admissions in each station being over 3,000 per 1,000, Peshawar following with 2,966: in each of these three stations over 2,000 of the admission-rate was due to fevers. As regards mortality, four stations, all of the Punjab, had death-rates of over 40 per 1,000—Jullundur 40·60, Amritsar and Govindgarh 46·61, Meean Meer 84·08, and the adjoining fortress of Lahore 137·93 per 1,000. This deplorable mortality was mainly due to cholera, as no less than 53;37 and 112·07 of the total death-rates of the two last stations were due to this disease. Of the total 80 deaths from cholera which occurred in the Punjab all but one were recorded in the above four stations. Among the stations with low death-rates were Saugor 2·69, Jhansi 2·80, Fort William 4·32, and Chakrata 4·74. Fort William continues among the healthiest stations of Bengal as is shown by the fact that its mortality for the year was less than one-half of what it was in 1878, viz. 9·36. The Army Sanitary Commission notice that in former times Fort William was the most unhealthy spot in India, or perhaps anywhere else, for European troops. Its death-rate for 10 years preceding 1866 was 102·35 per 1,000. Since then great improvements in

barracks, drainage, water-supply, &c., have been carried out, and in the decade 1860–69 the death-rate was 25·19 per 1,000, while in the ten years 1870–79 the mortality had fallen to 10·78 per 1,000.

In all respects the European army of Madras was healthier than either that of Bengal or Bombay, although there was a slight increase in mortality compared with the previous year. The admission-rate declined from 1,368 in 1880 to 1,160 per 1,000 of average strength, the daily sick from 64 to 60, while the death-rate rose from 10·18 to 10·97 per 1,000. In both years, however, the mortality was six per 1,000 less than the average of the preceding ten years. The most unhealthy station in the Madras command was Kamptee, which recorded a death-rate of 26·58 per 1,000, more than a half being due to cholera. In the previous year the mortality at this station equalled 20·73 per 1,000, but there were no cases of cholera. The stations of Cannanore and Bangalore and Tounghoo in British Burma furnished the most favourable mortality returns. At the two former stations the death-rate was a little over 5 per 1,000, and in the latter 4·44.

There was a great improvement in the health of the European troops in the cantonments of the Bombay Presidency, the admission-rate having decreased from 2,150 in 1880 to 1,784 per 1,000 in 1881, the daily sick from 78 to 72, and the mortality from 30·90 to 13·44. The average death-rate of the decennium 1870–79 was 15·27. The statistics of individual stations shows that Aden was the most healthy. There the admissions were 805, the daily sick 32, and the death rate only 3·96 per 1,000 against 20·35 in 1880. The stations which returned the highest death-rates were Nasirabad, Baroda, Ahmedabad, Karachi and Ghizree, and Ahmednagar, these ranging from 18·84 to 27·21 per 1,000.

The force on service in Afghanistan was composed of troops partly from Bengal and partly from Bombay, and, as shown in the statement at the beginning of this section, that portion of the European Army of India furnished the most unfavourable returns. The admission-rate (968 per 1,000) was low, but the daily sick-rate (72) was high, as was also the death-rate (51·55 per 1,000).

Cholera.

Cholera was the cause of 137 deaths, equal to 2·33 per 1,000 of strength against 2·81 in 1880. The disease was chiefly confined to the Bengal Army, and resulted in a mortality of 116 or 3·22 per 1,000. It prevailed as an epidemic at Meean Meer from June to August, during which time exactly one half of the 116 deaths which occurred in Bengal took place. About the same period there were 13 deaths at Fort Lahore; and later in the season there were 17 deaths at Lucknow. In the Madras Army there were 18 cholera deaths or 1·73 per 1,000 of strength, and in Bombay only three deaths. The troops in Afghanistan were entirely exempt from the disease. "The practical "result of the history of cholera at stations of European troops is," the Army Sanitary Commission remark, "that in the course of improvements at these stations a great "reduction in the death-rate from cholera has taken place, but that the disease shows "a tendency to periodical outbreaks at certain well-known stations. It is at these that "special sanitary precautions should be taken, and if there are no known means of "reducing the recurring mortality, the probability will be that the causes are topo-"graphical, and that there are such causes is well known in the history of cholera. The "remedy in such cases is also well known, and this is simply leaving the locality."

Fevers.

Fevers as usual caused the greatest amount of sickness in the three armies, the admissions per 1,000 of strength, excluding troops in Afghanistan, being 770 in Bengal, 280 in Madras, and 845 in Bombay. The most prevalent form was the intermittent, but enteric fever the most fatal. The admissions in the entire army on account of this fever numbered 328 against 470 in 1880, and the deaths 155 or 2·64 per 1,000 against 217 or 3·63. In Bengal the death-rate due to enteric fever was 2·62 against 3·69 in the previous year. Although the disease had been very widely distributed in Bengal, its prevalence was most marked at the stations of Lucknow, Rawalpindi, Bareilly, Meean Meer, Dum-Dum, and Ranikhet, among which there were 109 admissions and 33 deaths, being a little over one-third of the total (94) deaths. In Madras the enteric fever death-rate was 0·58 per 1,000 against 1·36 in 1880, and in Bombay the mortality was less by over one-half, the ratio having fallen from 5·76 in 1880 to 2·83. Among the troops employed in Southern Afghanistan, the death-rate on account of enteric fever was 10·62 per 1,000.

The influence of age on mortality by enteric fever is again shown by the fact that 108 of the 155 deaths occurred among men under 25 years of age, being in the proportion of 4·56 per 1,000 of the strength at that age, while 1·57 were from 25 to 29, and 0·79 from 30 to 34 years of age. According to length of residence in India the mortality from this fever was distributed as follows: 2 years and under, 4·55 per 1,000, 3 to 6 years 2·07, 7 to 10 years 0·56, 10 years and upwards 0·40.

"There can be no doubt," the Army Sanitary Commission state, "that, whatever "may be the influence of local and climatic causes in predisposing to enteric fever, the "subject, the young soldier, is the main death cause, and that to obtain the highest "enteric fever death-rate, it is only necessary to send him to India and bring him back "under the short-service system . . . . The amount of fever and of fever liability "will no doubt vary in some years, but with the present terms of army service this "fatal fever will form an important item in the Indian Army death-rate. This is the "result of long past as well as of present experience, and all that can be done of a "practical character is to try to diminish liability in young soldiers first landing in India, "by having drill completed before landing in India, by exercising great care over the "habits of these young men until they are accustomed to the climate, by placing as "many of them as possible at hill stations, and by rigid attention to every local sanitary "precaution. The need for this last recommendation appears to be shown by the fact "that there are stations scattered all over India in all varieties of Indian climates and "temperatures at which the amount of enteric fever is much greater than at others."

Venereal diseases.

Next to fevers, venereal diseases caused the greatest amount of sickness. The experience of the year respecting these complaints, Dr. Cuningham observes, again proves the failure of the lock hospital system: "Taking the statistics of the last 12 years, "during which the returns of the army of the three Presidencies have been tabu-"lated on the same plan, and during which period also the lock hospital system has "been very generally adopted, it is found that the admissions into hospital from "venereal diseases are as great as ever." For the entire army the admission-rate for 1881 was 260 per 1,000, just 10 per 1,000 higher than that of the previous year, and 57 per 1,000 in excess of the mean of the 10 years 1870–79. Excluding troops in Afghanistan, the admissions in Bengal were 276 per 1,000, the same as in 1880, and 67 per 1,000 higher than the average of the preceding decennium; in Madras the admissions declined from 275 per 1,000 in 1880 to 258; and in Bombay from 269 to 261. It will thus be seen that upwards of one-fourth of the army was infected with these diseases during the year.

There was a considerable increase of primary syphilis in Bengal, but a decrease in Madras and Bombay; and the fact that there has been no diminution in the proportion of secondary syphilis supports the opinion that lock hospitals have been of little help in rendering the type of the disease less virulent. These unfavourable results, Dr. Cuningham again points out, "may in some measure be accounted for by the "increased youth of the army, and by the smaller proportion of married men; but "making every allowance for these factors, the failure of the lock hospital system is "still most decided."

Invaliding.

The invaliding statistics show that 2,241 men, equal to 38·36 per 1,000 of strength, were invalided during the year, of whom 778 were recommended for discharge from the service, and 1,463 for change. No satisfactory comparison can be made with the results of 1880, owing to the non-receipt of the returns of several corps in that year. Compared, however, with the average of the 10 years 1870–79 (43·04), the ratio for 1881 stood about 4½ per 1,000 lower. The invaliding rate was highest in Bombay, 53·35, Bengal following with 36·92, while Madras returned 27·91. The chief causes of invaliding were debility, hepatitis, dysentery, diarrhœa, and phthisis. According to age 33·74 per cent. of the total number invalided were under 25 years of age, and 34·58 per cent. from 25 to 29 years of age. As regards residence, 14 per cent. of the total invalided had been less than two years in India, and 30·20 per cent. had served there from two to five years.

Dr. Cuningham in his report gives a table showing the unfavourable influence of the climate of India on newly arrived regiments as compared with the health of the army generally, and from this it appears that the admission-rate of new regiments was over 200 per 1,000 higher than that of the army as a whole, the daily sick 5 per 1,000, and the death-rate over 6½ per 1,000 higher. From enteric fever the death-rate was 8 per 1,000 higher.

Intemperance.

Owing to the discrepancies in the figures as to the extent of intemperance in different regiments of the European army, the returns have been discontinued.

II.—NATIVE ARMY.

Sickness and mortality in 1881.

In the health of the Native troops there was a very material improvement in 18[illegible] the mortality having been little more than one half of what it was in the previous yea[illegible] and there having been also a marked diminution of sickness. Of an average presen[illegible] strength of 114,613, the admissions into hospital were 1,305 per 1,000, against 1,545 i[illegible] 1880; the daily sick 46, or 10 per 1,000 less; and the death-rate 19·24 against 39·22 [illegible] including men absent from their corps, the mortality equalled 22·62 against 41·12 pe[illegible] 1,000. The ratios for 1881 were considerably lower than the means of the quinquenniu[illegible] ending with that year. Of the chief causes of sickness and mortality, nearly one-half o[illegible] the admissions was due to paroxysmal fevers, and one-third of the deaths was occasione[illegible] by respiratory diseases. Cholera deaths numbered 111, or 1·94 per 1,000, against 67, [illegible] or 0·97 in 1880.

The sickness and mortality of the various portions of the Native army are shown in the following table :—

	Average Strength.	Ratio per 1,000.		
		Admissions.	Daily Sick.	Deaths.
Bengal Native Army	38,721	1,494	52	23·84
Ditto ditto excluding Afghanistan	36,896	1,495	51	19·76
Madras Native Army	28,533	997	41	12·02
Bombay Native Army	24,945	1,471	50	25·58
Ditto ditto excluding Afghanistan	18,349	1,166	41	14·01
Central India Regiments	5,039	815	26	12·11
Punjab Frontier Field Force	10,307	1,718	55	17·95
Hyderabad Contingent	7,068	673	24	7·78
Native Army of India	114,613	1,305	46	19·24

Bengal Native Army.

It will be seen from the above that about one-third of the men composing the Native army of India belonged to the Bengal command, and that of these nearly 2,000 were on service in Southern Afghanistan. The statistics of the Bengal troops in cantonments for 1881 compare very favourably with those of 1880, the admissions per 1,000 of average strength having fallen from 1,609 to 1,495, the daily sick from 65 to 51, and the mortality from 33·85 to 19·76. Under nearly every heading of disease there was a diminution in mortality, the decrease being most marked under respiratory diseases, the death-rate having decreased from 7·21 in 1880 to 6·59 per 1,000 in 1881; fevers also declined from 9·19 to 3·12, bowel complaints from 6·13 to 2·74, and cholera from 1·52 per 1,000 to 0·92.

The following table shows the sickness and mortality of the five groups of cantonments in which the regular Native troops in Bengal were stationed in 1881 :—

	Ratio per 1,000.		
	Admissions.	Daily Sick.	Deaths.
Bengal Proper and Assam	1,772	63	22·53
Gangetic Provinces	1,260	46	15·78
Rohilkund and Meerut	1,378	60	15·67
Agra and Central India	1,380	41	9·35
Punjab	1,521	48	22·86

In every group there was a great decrease in mortality, and was most marked in the Agra and Central India group, in which the death-rate fell from 28·52 per 1,000 in 1880 to 9·35. The Punjab group also shows a satisfactory improvement in this respect, the death-rate being 15·16 per 1,000 less than that of the previous year, and in the Bengal and Assam group the mortality although high was but little more than half the ratio of 1880. Fevers, as usual, were the chief causes of sickness in all the groups, and were more prevalent in Bengal and Assam than in any other group. In this group also the admissions from bowel complaints were more numerous than in any other, while respiratory diseases and all the other forms of sickness in which malaria plays a

prominent part were very prevalent. As a proof of the malarial character of the diseases in the Bengal and Assam group it may be stated that one-half of the total death-rate (22·53) was due to fevers, bowel complaints, and respiratory diseases. The same may be said of the Punjab group, where three-fourths of the total mortality (22·86) were recorded under these headings.

The statistics of individual stations show that sickness was most prevalent at Dharmsala, where the admission-rate reached 2,752, of which no less than 2,142 were ascribed to fevers. Delhi comes next with 2,732, over 2,000 of which were due to fevers. Four other stations, Meean Meer, Alipore, Barrackpore, and Dinapore, recorded admission rates of over 2,000. The greatest mortality was registered at the station of Nowshera, 53·18, Fyzabad following with 50·82. In the previous year the death-rate at the latter station was 96·67 or nearly twice as high. The greatest number of deaths occurred at Peshawar and its outposts, where out of a total of 90, as many as 55 were due to respiratory diseases.

Among the Bengal Native troops in Southern Afghanistan the admission-rate, 1,475 per 1,000 of average strength, was by no means great, but the death-rate, 106·30 per 1,000, was more than five times the average of the Bengal troops in cantonments. The total deaths numbered 194, of which 55 were due to respiratory diseases and 57 to bowel complaints, while paroxysmal fevers gave rise to 24 deaths and anemia and debility 11, so that under these four headings 147 of the total deaths were due, more or less directly, to malarious influences. Neither cholera nor enteric fever attacked this force.

In the Punjab Frontier Force there was a diminution of sickness and also of mortality. Excluding troops in Afghanistan the admissions decreased from 1,874 per 1,000 in 1880 to 1,718, and the mortality from 24·03 to 17·95. Out of 185 deaths 88, or nearly one-half, were attributed to respiratory diseases, and 24 to fevers, 5 of which were recorded as enteric. There was no case of cholera in this force.

The rates of sickness and mortality in the Central India Regiments and the Hyderabad Contingent also show a satisfactory decrease. The admission-rate of the former was 815 per 1,000 against 1,131 in 1880, and the death-rate 12·11, less than half what it was in the two previous years. Nearly one-half of the total 61 deaths in this force was due to respiratory diseases, and 12 to fevers, while cholera was absent. But of all Native corps the Hyderabad Contingent was the most healthy, the mortality being only 7·78 per 1,000, which is almost identical with the two previous years, and the admission-rate was as low as 673 per 1,000 against 1,030 in 1880. In this contingent there were 12 cases of cholera, four of which proved fatal.

Madras Native Army.

In the health of the Native troops of Madras, there was a considerable improvement. The admission-rate (997) was 400 per 1,000 lower than in 1880; the daily sick (41) 13, while the death-rate decreased from 15·57 to 12·02 per 1,000, or, including absent deaths, from 19·54 to 16·75. From nearly every cause of disease there was a decrease in mortality excepting cholera, and from this disease the deaths rose from 3 in 1880 to 39. Of this number, 14 occurred at the station of Kamptee, and 18 at Trichinopoly. Of the total 343 deaths, 51 were attributed to fevers, 42 to bowel complaints, 33 to atrophy and anemia, and 45 to respiratory diseases. Dropsy was the cause of 29 deaths, but of these 20 were due to beri-beri, a disease which prevailed more or less generally throughout the year. Among the larger stations of the Madras Presidency, five returned death-rates exceeding 20 per 1,000, the highest, 32·66 per 1,000, having been recorded at Rangoon, Vizianagram coming next with 23·65, Kamptee with 21·82, Trichinopoly and Vizagapatam following with 21·65 and 20·93 respectively.

Bombay Native Army.

Over one-fourth of the Bombay Native Army was on service in Southern Afghanistan during the year; but for the unhealthiness of this portion, the returns would have shown much more favourable results. As regards the troops serving in cantonments, the admissions fell from 1,283 per 1,000 in 1880 to 1,186 in 1881, the daily sick from 45 to 41, but the death-rate, that is, of men present with their regiments, rose from 10·44 to 14·01; including absent deaths, the mortality of 1881 stands at 25·93 per 1,000 of total strength, less than half what it was in 1880, namely 56·93. It must not be forgotten, however, that the mortality of 1880 includes the casualties which occurred at Maiwand and Deh Kohja in Afghanistan. The greatest sickness occurred among the troops stationed in the Persian Gulf, the admission-rate reaching 2,457 per 1,000 of an average strength of 153. Judged, however, according to mortality, the most unhealthy station was Surat, which recorded a death-rate of 40·76, nearly half of which was due to cholera. Only at two other stations did the mortality exceed 20 per 1,000, and these were Karachi with a death-rate of 24·56 and Ahmedabad with 20·54. The chief causes of mortality among the troops in cantonments were respiratory diseases, fevers,

and bowel complaints, and under these three headings more than half the total 257 deaths were returned. From cholera there were 34 deaths.

Out of an average strength of 6,596 men composing the Bombay Native troops on service in Afghanistan during. 1881, the daily sick was 76 per 1,000, the admissions 2,317, and the mortality 57·76, all of which it will be seen were greatly in excess of the returns of troops in cantonments. Respiratory diseases were very fatal in this force causing no less than 218 of the total 381 deaths, and the ratio of admissions on account of these diseases was 301·2 per 1,000 as compared with 65·9 in cantonments. To dysentery and diarrhœa 49 deaths were attributed, and to fevers 34. Cholera was absent from this force.

III.—GENERAL POPULATION.

The following statement shows the registered mortality in the different provinces of India from the four principal diseases and from all causes in 1881 :—

Provinces, &c.	Cholera.		Small-Pox.		Fevers.		Bowel Complaints.		Deaths from all Causes.		
	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000 in 1881.	Ratio per 1,000 in 1880.
Bengal excluding Calcutta	79,180	1·32	34,371	0·40	949,911	15·71	57,020	0·95	1,255,478	20·96	15·40
Calcutta	1,893	3·91	133	0·03	3,705	8·49	1,491	3·44	13,036	30·00	27·19
Madras	9,446	0·32	15,766	0·55	203,542	7·09	18,961	0·60	465,632	16·20	15·71
Bombay	16,694	1·01	539	0·03	272,408	16·56	30,342	1·84	381,450	23·18	20·25
Punjab	5,207	0·30	6,749	0·38	355,279	20·32	17,281	0·99	519,779	29·72	27·03
North-Western Provinces and Oudh	25,865	0·58	17,153	0·39	1,100,599	24·95	82,814	1·88	1,402,473	31·79	29·99
Central Provinces	9,140	1·26	1,816	0·24	143,933	19·42	22,133	2·98	241,467	32·59	29·10
Berar	3,404	1·39	225	0·08	41,681	15·84	11,951	4·54	76,661	29·14	23·65
Assam	5,010	1·12	3,129	0·69	42,553	9·49	9,865	2·28	71,941	16·04	13·61
British Burma	5,839	1·42	1,766	0·48	27,743	7·51	3,868	1·03	58,136	15·75	17·32

For some years past the registration of births in Bengal has been confined to certain selected areas, but very little progress has been effected. Hopes, however, are entertained that better results will be secured when boards have been formed under the local self-government scheme. During 1881 births were registered in the same 46 towns as in the previous year, and the returns show a slight improvement, the number having increased from 35,779 or 23·44 per 1,000 of population to 38,856 or 25·51. In 20 towns the birth-rate was below the average, ranging from 5·92 to 24·68 per 1,000, and only in 16 towns were births recorded in excess of deaths. Bengal.

A greater number of deaths were registered in 1881 than in any year since registration was inaugurated in 1870. This is attributed partly to an improvement in registration, more attention having been paid to the subject by district and local officers, but chiefly to the great unhealthiness of the year, both cholera and fever having prevailed to a most unusual extent. The number of deaths recorded was 1,255,478 or 20·96 per 1,000 against 922,633 or 15·40 in 1880. Little reliance can, however, be placed in the ratios as they have been calculated on the census population of 1871, which is about 10 per cent. below that of 1881.

Cholera deaths rose from 39,643 or 0·66 per 1,000 to 79,180 or 1·32. These were recorded in 594 registration circles out of 674, and in 8 per cent. of the villages. The disease was most severely felt in the Presidency and Orissa divisions, displaying its greatest severity in the districts of Balasore, Nuddea, and Cuttack, where the death-rates were respectively 4·93, 3·38, and 3·34 per 1,000. Among the towns Poori suffered most, yielding 370 deaths or 16·30 per 1,000 of a population of 22,695. All the large fairs were exempt from cholera outbreaks during the year, and with the exception of Bankoora the chief pilgrim routes escaped. The Army Sanitary Commission consider that of all diseases cholera affords the least reason for interference with pilgrimages: "The question," they state, "should be dealt with on much broader grounds, because by far "the largest mortality from preventable epidemic diseases among pilgrims *en route*, and "even at Poori, the great pilgrim centre, has been shown in the present Report not to "be due to cholera." The year's experience as regards cholera in Bengal, "confirms," the Commission say, "but does not add to that of former years of cholera history. "It shows the erratic nature of cholera distribution over a great region of India, "and its presence in far greater intensity in some regions than in others, without "any assignable cause. The intensity of the disease in localities was as usual influenced "by local causes, certain of them connected with local topography, but, in the great "majority of cases cholera being over the district, it swooped down wherever its presence "was courted by insanitary local conditions; and experience of the results attending "the removal of these conditions in well-defined instances is hopeful for future progress "in improvements."

Small-pox deaths also rose from 22,953 or 0·38 per 1,000 in 1880 to 24,371 or 0·40 in 1881. Of these more than two-thirds occurred among children under 12 years of age. Deaths from this disease were recorded in 423 out of 674 registration circles, but only 8,759 villages out of a total of 200,321 were affected. Small-pox was most fatal in the five districts of Poori, Cuttack, Balasore, Noakhalli, and Chittagong, where the death-rate ranged from 6·09 to 0·92 per 1,000. The highest town death-rate was 17·53 per 1,000 in Poori, and in Balasore town the mortality reached 7·66. It is somewhat remarkable that in the Contai thana of Midnapore district, where inoculation is practised, not a single death from small-pox was reported, while the number registered in 1880 was 1,282. In Ranchi, where the disease had prevailed with some severity in former years, there was a great decrease in the number of deaths, only 12 being reported against 205 in 1880.

More fever deaths were registered in 1881 than in any previous year, the total being 940,941 or 15·71 per 1,000 against 689,605 or 11·51 in 1880. All the districts but two showed an increased mortality from this cause. In Nuddea the mortality attained most alarming proportions, and, notwithstanding that every effort was made to mitigate the sufferings of the people by the free distribution of medicines and other assistance, the fever death-rate rose from 29·53 per 1,000 in 1880 to 39·72. In consequence of this heavy mortality a Commission was appointed to visit the worst parts of the districts and to inquire into the conditions and causes of the outbreak. The Commission, it is reported, found no specific cause for the outbreak, and were satisfied that it was not due to artificial obstructions to natural drainage, as was popularly believed to be the case. They, however, drew attention to the insanitary condition of the villages, and pointed out a number of causes contributing to unhealthiness for most of which the villagers were themselves responsible. In their remarks on fevers in connexion with local and other influences the Army Sanitary Commission state: "Atmospheric causes may "influence the number of fever attacks, but the extent to which these attacks may prove "fatal is mainly dependent on purely terrestrial and local conditions over which we have "control. We can cleanse and keep clean our dwellings and surroundings, we can "protect water sources from impurity, we can keep the drainage of the country open, "and we can relieve water-logged subsoils by drainage; we can so construct even the "humblest dwelling as to avoid damp floors and damp walls without cost, and people "who at present sleep on damp floors may be induced to raise their beds in some way "above its level. If these things be done, and suitable provision for keeping cattle in "their proper place be made, other things are sure to follow, such as better working "power and better means for providing against atmospheric changes by food and "clothing, and as a necessary result, there will be a great reduction of fever and general "epidemic mortality."

From bowel complaints 57,029 deaths were recorded, equal to a ratio of 0·95 per 1,000 of population, against 44,969 or 0·75 in 1880. Deaths were registered in all the registration circles but 24, and in 12 per cent. of the total number of villages.

In Calcutta the year on the whole was an unfavourable one from a sanitary point of view. The registered deaths rose from 11,681 or 27·19 per 1,000 in 1880 to 13,030 or 30·0, calculated on the census population of 1881. The increase was chiefly due to cholera, the deaths from which were more than double the number of the previous year, namely, 1,693 against 805. From fevers there were 3,765 deaths, nearly the same number as in 1880, which is somewhat surprising, as in the adjoining districts of Nuddea and Moorshedabad fever mortality was exceptionally high. Small-pox also was slightly more fatal, the deaths having increased from 114 in 1880 to 133.

Madras.

There was a great scarcity of rainfall in all parts of the Madras Presidency during 1881, still food prices remained low; but the general health of the population was not so satisfactory as in the previous year. The total births registered was 731,866 or 25·5 per 1,000 against 659,991 or 22·9. This was a higher ratio than had been recorded in any of the preceding 12 years, and more than double the rate to which it was reduced in 1878, the year following the famine. It may be inferred therefore, that the registration, imperfect as it still is, was improving. The registered deaths numbered 465,682 or 16·2 per 1,000 against 454,101 or 15·7 in 1880, the increase being almost entirely due to cholera. The three highest district death-rates were 37·9 at Madras, 24·3 at Tanjore, and 21·7 at Chingleput. These three districts also recorded the highest birth-rates, and the satisfactory results obtained at the two latter is attributed to the special care and attention which the collectors had devoted to the subject.

The immunity from cholera, so characteristic of 1880, continued during the first nine months of 1881, when only 423 deaths were recorded, but during the last quarter of the year this pestilence made its appearance in the southern part of the Presidency, resulting in a total mortality of 9,446 against 613 in the previous year. Of these 2,220 were

registered as having died in the towns and 7,226 in the districts. The disease was principally felt in the Tanjore district, which recorded 2,801 fatal cases. Tinnevelly came next with 2,206, and Trichinopoly followed with 1,894. It will thus be seen that these three districts contributed more than two-thirds of the total cholera deaths. In discussing the facts connected with the history of this disease the Army Sanitary Commission show that for the 16 years ending 1881 cholera had prevailed more or less epidemically in the Presidency at certain periods, followed in each case by two years of comparative quiescence, and they are of opinion that 1881 was the beginning of another epidemic period. They call attention to this the more especially as certain officers were disposed to attribute the epidemic of the year under review to returning pilgrims from the Tirupati festival. "There is no proof," they state, "that it had any influence on the "course of a true cholera epidemic which covered Southern India."

Small-pox also was more prevalent than in the previous year, the deaths numbering 15,776 equal to 0·55 per 1,000, or 1,247 in excess of 1880. Ganjam, as usual, registered more deaths from this cause than any other district, viz., 3,038. Inoculation appears to be greatly practised in the more remote parts of this district, which, it is stated, no doubt accounts for its unenviable pre-eminence in regard to small-pox mortality. Young children were again the principal sufferers from this disease, for out of the total 15,776 deaths no less than 11,202, or considerably over two-thirds, occurred among children under 12 years of age.

Fever deaths were not quite so numerous as in 1880, the number having declined from 209,940 or 7·29 per 1,000 of population in that year, to 203,542 or 7·1 in 1881. In his report for 1881 the Sanitary Commissioner gives a table showing the number of fever deaths for each year since 1866, and from this it appears that during that period they have numbered 3,492,135. Dividing this period into two parts of eight years each, the deaths up to 1873 equalled 1,241,138, and for the subsequent eight years 2,250,997. Some allowance must be made for the heavy fever mortality of the famine years 1877 and 1878, but even omitting the deaths in these years, the number was considerably in excess of the octade ending 1873. The Sanitary Commissioner is unable to account for this augmentation in fever mortality, "unless it be the habit which obtains amongst the people all "over the country of poisoning, by filthy practices, their water-supply, and their exposure "by reason of their scanty clothing to vicissitudes of temperature." "No doubt," the Army Sanitary Commission observe, "there would be less fever if the whole Madras "population was suitably lodged, clothed, and fed. But experience in other parts of "India has shown that where malarial fever prevails with a certain degree of intensity, it "spares neither rich nor poor. Improved social conditions can alone supply the want which "Dr. Furnell (the Sanitary Commissioner) has dealt with, and climate cannot be altered."

Under bowel complaints 18,961 deaths were registered, equal to 0·6 per 1,000 of population, against 19,622 or 0·68 in 1880. These were returned from all the 227 registration circles except five.

Satisfactory improvement was made in the registration of vital statistics in the Bombay. Bombay Presidency during 1881. The number of registered births rose from 370,873 or 22·85 in 1880 to 459,657 or 27·93 per 1,000 of population, calculated on the census of 1881. The increase was general throughout the Presidency, for only one district (Bombay city) out of 24 showed a decrease in number. The total registered deaths was 381,450 or 23·18 per 1,000 against 328,673 or 20·25 in 1880. It will thus be seen that the excess of births over deaths equalled 4·75 per 1,000 of population. In all the five divisions into which the Presidency is divided except the Konkan, the death-rate was higher than in the previous year. By districts the death-rates ranged from 37·91 in Broach to 6·56 in Sind. The latter ratio, the Army Sanitary Commission state, is apparently under the truth; but in the other districts there has been much good registration work done.

Of the chief diseases, cholera deaths showed a considerable increase, from 684 in 1880 to 16,694 or 1·01 per 1,000 in 1881. The disease, however, was not universally prevalent, for no deaths were recorded in the Sind division. Deaths were registered in 18 out of the 24 districts, and in 144 registration circles out of 285, but only six per cent. of the villages were affected. Of the districts, Khandesh contributed 3,176 deaths, Surat 2,751, and Ahmednagar 2,645. The circumstance of the year being one of heavy cholera mortality would seem to confirm the theory of the triennial choleraic wave Statistics show, as the Sanitary Commissioner points out, that for 10 years, 1866 to 1875, the triennial occurrence was unbroken; in the eleventh and twelfth years the famine was a disturbing element, still the high number of deaths in the thirteenth year marked it as a recurrent year; the two next years showed a low mortality, and the sixteenth (1881) witnessed a renewal of the wave. In Bombay City there were 529 deaths against 30 in the previous year. The disease prevailed for 10 months out of the 12, and records show

that out of 408 months, making up the period from 1848 to 1881, it was present in this city in 389. With the view of showing the influence of improved sanitation on cholera visitations the Army Sanitary Commission divide this period of 34 years into two groups of 17 years each, as in the last period sanitary work in Bombay city has been more or less attended to. During the first 17 years, from 1848 to 1864, the cholera deaths numbered 37,454, and from 1864 to 1881 this number was reduced to less than one-third, namely, 11,026. "There is plenty of sanitary work," they say, "to be done in this "great city of 773,196 inhabitants; but these facts, extending over a long series of "years, appear to show that what has already been done has by no means been labour "in vain."

The Presidency was remarkably free from small-pox during the year. Only 539 deaths were registered, being a smaller number than in any previous year since 1872, and less by 401 than that recorded in 1880. This mortality was confined almost entirely to the Konkan and Sind divisions, only 26 fatal cases of the disease having taken place in the three divisions of North and South Deccans and Gujarat. Seven districts out of the 24 were entirely exempt from small-pox, in nine the deaths were below 10, and in the remaining eight, Shikarpur as usual came first with a maximum of 202, Karachi following with 102.

Fever deaths rose from 246,779 or 15·21 per 1,000 in 1880 to 272,403 or 16·56 in 1881, a number which is also in excess of the average for the previous nine years. In the districts of Bombay City, Belgaum, Dharwar, Kaladgi, and Ratnagiri, there was less mortality than in the previous year, but in the remaining 19 there was an increase. The highest district fever death-rate was 33·14 per 1,000 in Broach, and the lowest, 5·37, in the Upper Sind frontier district. This general increase in fever mortality is attributed to an improvement in registration. The Deputy Sanitary Commissioner of the Northern Deccan Registration District is of opinion that not more than one-fifth of the deaths recorded as being due to malarious fevers belong properly to that malady, "the "remainder being made up of simple continued fever, the result of climatic causes with "its frequent resultant pleurisy and pneumonia in an underfed and ill-clothed popula-"tion, and of typhoid fever. I consider," he says, "all these diseases, viz. cholera, "fever, and bowel affections, are propagated by contaminated water; and if the death-"rate is to be diminished, it can only be done by giving each village a good supply of "clean water; and I hold that a public well under proper supervision in every village "is a necessity more frequently calling for support, and is of more primary importance "than education or hospitals, or any of the hundred and one demands made upon and "granted out of village funds, whether local or municipal." But, while admitting the great danger to health of impure water, the Army Sanitary Commission point out that the purest water would afford no protection against either fever, cholera, or bowel complaints if other well-known causes of these diseases were left untouched. "Water unfit "for human use," they state, "on account of animal impurities is something else besides "a disease cause. It is a sign of filth and want of cleanliness about the water source or "in the subsoil which supplies it, and no amount of well-digging will be a permanent "advantage unless village cleansing and surface draining go along with it."

The deaths from bowel complaints were 30,342 or 1·84 per 1,000, being 5,890 in excess of 1880. In all the districts but five there was an increase, Khandesh recording the highest death-rate, namely, 3·68 per 1,000.

In the capital 21,856 deaths were registered during the year, exceeding the number of 1880 by 710. Calculated on the census population of 1881, the death-rate equalled 27·65 per 1,000. The increase in mortality was chiefly due to respiratory diseases and cholera, especially the former, the deaths from which rose from 1,973 in 1880 to 3,799. From cholera there were 546 deaths against 30 in 1880. On the other hand, fever deaths declined from 7,513 in 1880 to 6,437, and small-pox from 207 to 35.

Panjab.

Considerable improvement was effected in the registration of vital statistics in the Punjab in 1881. The year was the second of the registration of births for the whole province, and the returns give a total of 695,766 or 39·79 per 1,000 of population, against 544,659 or 31·15 in the previous year. The improvement was not confined to particular districts, but was almost general throughout the province, for only two out of 32 districts, viz., Ferozepore and Dera Ghazi Khan, showed a decrease. A further proof of the progress made in registration is the fact that the birth-rate exceeded the death-rate by nearly 10 per 1,000, and excepting in the four districts of Simla, Kangra, Amritsar, and Peshawar, births were everywhere more numerous than the deaths.

During the year 519,779 deaths were registered, equal to 29·72 per 1,000 against 472,731 or 27·03 in 1880, showing an increase of 47,048, which was due chiefly to a

considerable rise in mortality from cholera and fevers. The death-rate of the rural circles equalled 29 per 1,000 and that of the towns 48. By districts Amritsar recorded the highest mortality, namely, 50 per 1,000 against 29 in 1880, the excess being caused by a severe epidemic of fever in the town. Lahore came next with a death-rate of 41 per 1,000, being 10 per 1,000 in excess of the previous year, which was also due to fever. Ten other districts had death-rates ranging from 38 to 30, and 17 from 30 to 20 per 1,000. The highest town death-rate was 125 per 1,000 at Amritsar, Lahore following with 56. Of the total deaths 46 per cent. occurred among children under six years of age.

Of the chief diseases cholera showed a considerable increase, the deaths having risen from 274 in 1880 to 5,207 or 0·30 per 1,000 in 1881. Eight districts out of the 32 were entirely exempt from the disease, in eight others the deaths ranged from 1 to 6, in 13 the epidemic influence was mild, while in Lahore, Jullundur, and Amritsar it prevailed with great severity, especially in the former district, which recorded nearly a third of the total cholera mortality. Of the 5,207 deaths, 3,693 occurred in the municipal towns, the remainder in the rural circles. All the deaths were registered in 371 villages out of 34,973. A detailed account of the epidemic in its sanitary aspects is given in the Sanitary Commissioner's Report, and the facts adduced "clearly show," the Army Sanitary Commission observe, "that although much has been done of late "years to improve the Punjab towns, as is evidenced by reduced liability to cholera, "there is plenty of work to be done by the new municipalities of a thoroughly practical "character. In the Punjab, as in other parts of India, the great predisposing disease-"causes are to be found, not in public streets and places, but within the houses and "compounds, and however cleaned and well drained and paved a public street may be, "it by no means follows that public health in low, filthy, damp localities will be "improved thereby."

Fewer deaths were registered from small-pox than in any previous year. They numbered 6,749 or 0·38 per 1,000 against 9,145 or 0·52 in 1880, and 49,489 or 2·83, in 1879. All the deaths but 445 occurred among children under 12 years of age. The disease was almost exclusively confined to the frontier districts, and was fatally prevalent in those of Peshawar and Dera Ismail Khan, which together yielded 2,875 deaths. "Although," the Sanitary Commissioner states, "there has been a most marked reduction "in the small-pox death-rate in the last two years of 1880 and 1881, this diminution is by "no means the result of the spread of vaccination. It must not for a moment be supposed "that, because there have been only isolated cases in some districts, the disease was "'stamped out' in them. The painful memories of the havoc committed by this "loathsome malady so lately as in 1878–79 are still fresh in the minds of the people. "The enemy is surely not dead, but awaits for favourable circumstances—whatever "they may be—to renew its work of destruction." It is satisfactory, however, to learn that since the amalgamation of the Vaccination with the Sanitary Department the Vaccination service has been reorganized and considerable additions made to the number of vaccinators, and it is hoped that under the new system district authorities will more earnestly co-operate in extending the benefits of vaccination among the people.

Under the head of fevers 355,279 deaths were registered, exceeding the number of the previous year by 27,552, the death-rate per 1,000 of population being 20·32 against 18·74 in 1880. The highest fever mortality was recorded in the district of Amritsar, namely, 35 per 1,000; Lahore also suffered very severely, the death-rate being 27 per 1,000; and in the districts of Delhi, Karnal, Umballa, Mooltan, and Muzaffargarh, the death-rates were very high. Out of the 28,962 fever deaths in Amritsar district, 11,724 occurred in the city alone, equal to a death-rate of 81 per 1,000. The outbreak was attributed to excessive and unusual rainfall, obstructed drainage, rise of the spring level, and consequent water-logging of the soil, combined with insanitary condition of crowded dwellings, imperfect conservancy, and contaminated water-supply. The Deputy Sanitary Commissioner (Dr. Bennett), who investigated the circumstances connected with this Amritsar outbreak, states in his interesting report that "at a comparatively early period "of the outbreak the sickness was so universally prevalent, that not a single individual, "Native or European, in the city and civil station appears to have escaped its attacks; "nine-tenths of the shops are said to have been closed, and the work of the Government "offices was carried on with the utmost difficulty owing to the general prostration and "fever." The mortality was heaviest among the poorer classes, and cholera being prevalent added to the general distress. Children appear to have suffered to an appalling extent. "It would probably be no exaggeration to say," Dr. Bennett writes, "that two-thirds of the infantile population have died since the commencement of the "outbreak, and that the health of the remaining third has been so shattered that

" comparatively few, among the poorer classes especially, are likely to survive beyond " their fifth year." In their remarks on this subject the Army Sanitary Commission state: " The history of this Amritsar fever is of great importance as showing the relation " of local and personal causes to abnormal rainfall in the chain of events, while it yields " an epitome of the action of fever-causes over most districts in India. But it does " more than this, for it shows in another form what relation to public health may at any " time exist between canal irrigation without drainage and abnormal rainfall." The investigation into the causes of this fever outbreak resulted in the issue of orders to remedy the defects of drainage and conservancy, and schemes for draining the whole locality with a view of obviating the swamping and water-logging of the soil and for improving the water-supply were under consideration.

Deaths ascribed to bowel complaints fell from 20,736 or 1·18 per 1,000 in 1880 to 17,281 or 0·99 in 1881, showing a decrease of 3,455. Out of 34,973 population groups, this mortality was confined to 6,099. Simla, as usual, recorded the highest district death-rate, namely, 2·83 per 1,000.

North-Western Provinces and Oudh.

Satisfactory progress has been made in the registration of vital statistics in the North-Western Provinces and Oudh since its introduction in the combined provinces in 1879. During 1881 the registered births number 1,779,473 or 40·34 per 1,000, calculated on the recent census, which showed the population to be 44,107,869. In the previous year there were 1,390,870 births registered, equal to 32·55 per 1,000. In all districts excepting Kumaon, Terai, Dehra Dun, Fyzabad, and Ballia, the births exceeded the deaths, while in the previous year there was an excess of deaths over births in 25 districts. On the whole the birth-rate was higher than the mortality by 8·55 per 1,000. This general improvement was to a very great extent due to the new system of registration introduced during the year, under which every village watchman keeps a nominal register of births and deaths. A number of these registers was inspected by the Sanitary Commissioner, and he was satisfied as to their correctness.

The registered number of deaths was 1,402,473 or 31·79 per 1,000 against 1,281,155 or 29·99 in 1880. The district death-rates varied from 47·33 per 1,000 in Terai and 41·45 in Cawnpore to 20·76 in Dehra Dun, and the town death-rates ranged from 115·26 in Ajudhia to 16·31 in Muzaffarnagar. In many districts and municipalities the registered mortality was apparently below the truth, " but taken generally," the Army Sanitary Commission observe, " the recent improvements in registration methods have " led to more exact record of facts."

Cholera was considerably less prevalent than in 1880, the deaths having declined from 71,546 or 1·67 per 1,000 to 25,865 or 0·58 in 1881. These were registered in all the districts, but out of 117,630 centres of population only 4,573, being less than 4 per cent., furnished deaths. In his report for the year under notice the Sanitary Commissioner gives an account of the great fair (Magh-Mela), which was held at Allahabad in January 1882. The fair commenced on the 5th of that month, and lasted to the 3rd of February, and it is estimated that 3,000,000 of people attended it, the average attendance being about a million. Cholera broke out among the pilgrims on the 16th, and thenceforward continued with great severity. The outbreak would seem to have been greatly aggravated by overcrowding and the absence of sanitary precautions in the vicinity of the fair. The people becoming alarmed began to disperse, and by the 20th of the month the most severely affected areas were vacated. During the next three days the space between the station and the city was crowded with pilgrims trying to get away, and every day cholera cases were carried to the city hospital, a considerable number proving fatal. About 25,000 people left daily by the trains, among whom, as the Sanitary Commissioner remarks, were doubtless many affected with the disease. But no general outbreaks of cholera appear to have followed amongst the population through which the returning pilgrims passed or in the districts of their homes. With reference to the alleged spread of cholera from this fair, Dr. Cuningham states: "The experience of fairs and other " gatherings in India has again and again testified to the conclusion that cholera is not " carried by persons from one locality to another, so as to cause persons not themselves " exposed to the necessary local influences to become affected by the disease. Coinci- " dences certainly can be cited, in which the arrival of persons from a cholera-affected " district has been clearly followed by an outbreak of the disease; but even these " coincidences are far fewer than is generally supposed. An illustration of such a " coincidence is furnished by the history of the Magh mela."

Soon after the dispersion of the pilgrims from Allahabad, a fair was held at Hurdwar, about 450 miles north-west of Allahabad, but on a much smaller scale, the average daily attendance being 60,000. The fair commenced on the 6th of April and terminated on

the 16th. In contrast to Allahabad, the sanitary arrangements were highly satisfactory; only one cholera case occurred, which resulted in recovery. The Sanitary Commissioner states that he stayed at the fair until the assemblage had quite dispersed, and inquired carefully concerning the welfare of the retiring pilgrims, but neither saw nor heard any mention of disease among them.

Small-pox deaths rose from 8,240 or 0·19 per 1,000 in 1880 to 17,153 or 0·39. Of these, 15,401 were registered during the first six months of the year, chiefly in the months of the hot season, March, April, and May. Deaths were registered in all the districts, and in 673 registration circles out of 1,107. Although the epidemic covered a wide area, a very small number of population centres suffered—about one in fourteen—and in these, as noticed by the Army Sanitary Commission, the epidemic was of very low intensity, and showed little disposition to spread beyond the first cases attacked.

Fevers caused 1,100,599 deaths or 24·95 per 1,000 against 987,220 or 23·11 in 1880. But under this head a variety of diseases are supposed to have been registered; therefore, as the Sanitary Commission observes, "any small increase or decrease must "not be taken to indicate with certainty any increase or decrease of fever prevalence." All the districts returned fever deaths, and all the 1,107 registration circles with the exception of 16. In 18 districts the mortality was very high, Terai, as usual, coming first with a rate of 41·41, and Meerut, Bareilly, Ghazipur, and Ballia following with death-rates of over 30 per 1,000, while in 13 others the ratios ranged from 29·50 to 26·29. Of these 18 districts, eight are canal irrigated, and have always recorded high fever mortality, which the Sanitary Commissioner attributes to excessive moisture arising out of canal irrigation. In four other irrigated districts, with ratios ranging from 25·46 to 22·24, there was a decided falling off in fever mortality, which the Sanitary Commissioner says is satisfactory, and may result from the action of drainage works and a more careful distribution of water. "If this view be accepted," the Army Sanitary Commission state, "it would follow that these drainage works had not only greatly reduced the liability to "fever in the districts, but had removed the excess of rain, and consequently the "additional mortality which otherwise might have been due to it."

Under bowel complaints 82,184 deaths were registered against 80,312 in 1880, the ratio being 1·88 per 1,000 in both years. All the districts contributed deaths, and 1,029 out of the 1,107 registration circles. In eight districts the mortality was unusually high, averaging 6·7 per 1,000. Of these, Cawnpore showed the greatest increase, the death-rate having risen from 1·4 per 1,000 in 1878 to 6·3 in 1881.

Central Provinces.

The number of births registered in the Central Provinces during 1881 was 362,744 or 48·94 per 1,000 of population against 332,438 or 44·87 in 1880. The increase was pretty general, for only in four districts out of 20 was there a decrease, and in every district but one the birth-rate was over 40 per 1,000, whereas in 1880 six districts were below that ratio. In all districts the births exceeded the deaths, and, with few exceptions, in the towns also. Except for the sake of comparison, however, the ratios are of little value, as they have been calculated on the population of 1872, which the census of 1881 shows to have increased to the extent of about 25 per cent. A striking proof of the need for correction is given by the Sanitary Commissioner in the case of Murwara town, which recorded a birth-rate of 83·54 per 1,000 and a death-rate of 112·30, but which, calculated on the population of 1881 are reduced to 27·98 and 37·62 respectively, the population having increased from 2,885 in 1872 to 8,612 in 1881.

Of registered deaths there were 241,467 or 32·59 per 1,000 against 215,647 or 29·10 in 1880. Although showing an increase of 25,820, the year was not on the whole an unhealthy one; food grains were abundant and cheap, and in most districts the condition of the people was reported to have been more satisfactory; the increase in mortality would therefore seem to point to an improvement in registration. By districts the death-rate varied from 43·93 per 1,000 in Narsinghpur to 26·58 in Burhanpur. The average town death-rate was 40·65 per 1,000 against 32·59.

In the previous year there were only 350 cholera deaths; but in 1881 this number had increased to 9,149; though considerable, this number was small compared with 40,985 in 1878 and 27,575 in 1879. The disease was present in every district; the mortality, however, was strictly local, for only in 1,132 population groups out of a total of 27,247, including 72 towns, were deaths registered. One half of the towns were exempt from the disease, and with the exception of Kamptee, all the most populous towns were comparatively free. As pointed out by the Army Sanitary Commission, Nagpur yielded only 60 cholera deaths out of a population of 84,441, and Jubbulpore, although connected by roads and railroads with cholera-infected regions, had only 47 deaths out of a population of 43,223, while Saugor town, with 31,119 inhabitants,

escaped the disease. "These statistical facts," the Commission observe, "appear to "justify an opinion that sanitary work, such as it was, in the towns and under the "prevailing epidemic conditions, had been effective in saving life."

Small-pox was less prevalent than in any year since 1869, there being only 1,816 deaths against 5,184 in 1880. Every district was affected, but the outbreaks were local, as is shown by the fact that only 879 villages out of 27,247 returned deaths. Of the total mortality 35·4 per cent. occurred among children under one year of age, and 44·5 per cent. among children between one and twelve years. During the five years ending 1881 there had been 51,411 fatal cases of small-pox in these provinces and 1,507,288 vaccinations, equal to about one death for every 30 operations.

Deaths from fevers rose from 136,840 or 18·46 per 1,000 in 1880 to 143·933 or 19·42 in 1881. There was a general prevalence of fevers, no less than 21,497 villages having returned deaths. The district death-rates ranged from 5·89 at Nagpur to 32·24 at Narsinghpur. There is apparently, the Sanitary Commissioner states, too small a proportion of deaths returned from fever in some districts, while in others they are reported in undue numbers, and this he attributes to the too common practice of including almost every death under fevers.

From bowel complaints 22,133 deaths were registered against 19,205 in 1880, all being returned from 7,535 population groups, which the Army Sanitary Commission remark throws doubts on the records or on the diagnosis.

Berar.

A considerable advance was made in the registration of vital statistics in Berar in 1881, and now that the revised rules for simplifying and improving the system referred to in Vol. XIV., p. 13, have received the sanction of Government, still further progress is expected in the future. The registered births for the year numbered 104,921 or 39·9 per 1,000 of population, according to the census of 1881, against 91,105 or 41·7 in 1880. The nominal decrease in the birth-rate is explained by the fact that the population had increased to the extent of 20·3 per cent. since the census of 1867. Had the birth-rate been calculated on the census of that year it would have equalled 48 per 1,000. In all districts births were in excess of the previous year, and in all cases they were more numerous than the deaths, the average excess for the entire province being 10·8 per 1,000.

The total number of deaths registered was 76,661 or 29·1 per 1,000 against 51,725 or 23·6 in the previous year. The increase of 24,936 deaths was due mainly to the prevalence of cholera, fevers, and bowel complaints, and to improvement in registration. The district death-rates ranged from 33·1 per 1,000 in Akola to 25·0 in Wun and 25·6 in Amraoti.

In 1880 cholera was entirely absent from the province, but in 1881 there were 3,404 deaths from this disease, showing a death-rate of 1·3 per 1,000. During the last 14 years, that is from 1868 to 1881, there has been a very great variation in the cholera death-rates. "No deficiencies," the Army Sanitary Commission state, "would account "for them. They show a tendency to triennial periods subject to sudden augmenta- "tions in intensity, for which at present no reason can be assigned unless the facts be "taken to show that the most predisposed part of the population are suddenly cut off, "and then the disease subsides for a time." All the districts were visited by cholera, the greatest number of deaths having taken place in Buldana, Basim, and Akola, which together yielded 2,615 fatal cases. Several towns were entirely free from the disease, but in Malkapur and Akola towns the ratios were very high, viz. 8·1 and 9·8 per 1,000 respectively.

From small-pox the deaths rose from 39 in 1880 to 225. The only district in which the disease prevailed in an epidemic form was Akola, which contributed 196 of the total deaths; while Basim remained entirely exempt from the disease. Children were the principal sufferers, 104 of the deaths having occurred among those under one year of age, and between one and six years there were 106 deaths. "During the last three years," the Sanitary Commissioner remarks, "the recorded mortality from small-pox has been "very much less than for any of the preceding ten years, and though this may be due "in some measure to less severe visitations of the epidemic, still it does not seem "unreasonable to suppose that this comparative freedom from disease may also in a great "measure be due to the vigorous and earnest manner in which vaccination was carried "on in this province."

The mortality under fevers was very great, the deaths numbering 41,681 or 15·84 per 1,000 against 31,027 or 14·18 in 1880. In each district there was a considerable increase. The maximum mortality to population was in the Wun District, namely 21·1 per 1,000, with an average rainfall of 44·11 inches; and the lowest mortality was 13·7 in

Buldana, where also the rainfall (26·20 inches) was less than in any other district. "In Wun District," the Sanitary Commissioner states, "the villagers use charpoys for sleeping "on to a very much greater extent than in any other district of Berar, yet the fatality "from fevers is always highest in this district." "This apparently exceptional result," the Army Sanitary Commission remark, "may possibly be due to local conditions of "surfaces and subsoils, but it may also depend in part on the law of rain distribution, "for, if the mass of the year's rain in Wun falls just before the time of increase of fever "in other districts, Wun may suffer to a greater extent from this cause. All such "exceptional cases merit investigation, because they throw important light on sanitary "work. But it must also be borne in mind that a great part of fever mortality every-"where, and especially in Indian towns and villages, is due to aggravation of fever cases "by purely local causes in and around dwellings."

The number of deaths ascribed to bowel complaints was 11,951 or 4·5 per 1,000 against 7,997 or 3·6 in 1880. The classification of bowel complaints is stated to be still very imperfect, deaths due to many other causes being classed under this head by the village registering agency.

Assam.

The sanitary history of Assam in 1881 shows a remarkable improvement in the registration of vital statistics. In former years births were registered only in eight towns, but during the year under review the system was extended to six districts of the province. In the other two districts under registration, namely, Sylhet and Cachar, birth registration was to take effect in the former from 1st July 1882, while in the latter it appears that births have been recorded for many years, but by an oversight the statistics had never been returned, nor included in the provincial reports. In the six districts above alluded to, namely, Goalpara, Kamrup, Nowgong, Darrang, Sibsagar, and Lakhimpur, the number of births registered was 42,733 or 19·20 per 1,000, exceeding the death-rate by 2·27 per 1,000.

Deaths were registered to the number of 71,941 or 16·04 per 1,000 against 51,666 or 13·61 in 1880. The improvement which has taken place in the registration of deaths is somewhat obscured by the fact that the death-rate of 1881 was based on the census population of that year, which was found to have increased to the rate of 18½ per cent. since the taking of the previous census in 1871–72. All districts showed an increased mortality compared with the previous year, especially Kamrup, Nowgong, and Sylhet.

With regard to the causes of mortality, cholera was much more prevalent than in 1880, the deaths having risen from 2,803 or 0·74 per 1,000 to 5,010 or 1·12 in 1881. Although the disease was present as usual in each month of the year and in each district of the province, there does not appear to have been any great epidemic outbreak. Kamrup suffered more than any other district, recording 1,719 deaths or 2·66 per 1,000; Nowgong and Sibsagar followed with death-rates of 2·35 and 2·05 respectively. In the other five districts the mortality ranged from 0·84 to 0·02 per 1,000. Silchar was the only town that escaped the disease. Of the other seven, Gauhati recorded 216 deaths or 18·47 per 1,000, which was the highest local rate of the year. Cholera deaths were reported from 201 out of 389 registration circles, and from 620 villages out of 17,355. "Local damp or wet ground," the Army Sanitary Commission observe, "local "filth and its consequences, foul well and tank water, appear to be the principal "determining causes of cholera in Assam," and the protection of water sources from surface and subsoil filth must form an essential element in the sanitary improvement of every town and village in the province.

From small-pox there were 3,129 fatal cases or 0·69 per 1,000 against 2,239 or 0·59 in 1880. The disease prevailed throughout the province, no district or town escaping the scourge. According to ages 639 deaths were registered among children under one year of age, and 1,562 under 12 years. Small-pox was most markedly severe in Nowgong, where 197 villages registered 549 deaths, equal to 1·77 of population, and in Sibsagar 493 deaths were recorded in 194 villages, showing a death-rate of 1·33 per 1,000. In the districts of Goalpara and Cachar the death-rate was at a minimum, but in each of the other three districts the death-rates ranged from 0·60 to 0·67.

Of fever deaths there were 42,553 or 9·49 per 1,000 against 31,272 or 8·24 in 1880. The highest district fever death was 14·39 at Darrang, Nowgong coming next with 12·66; in four other districts the mortality ranged from 8·99 to 10·90, and in Lakhimpur and Cachar 5·85 and 4·32 were their respective rates. In the Goalparra district fevers are reported as being the scourge of the population, no less than 4,840 of the total 5,855 deaths from all causes having been recorded from them. The heavy fever mortality in the Nowgong district, the Civil Surgeon reports, "is easily to be "accounted for by the fact of heat and wet acting on the heaps of filth collected in

" villages and producing poisonous vapours, the influence of which the people, in an " already enfeebled state, are unable to withstand." The year's experience of Assam fevers tends to show, as the Army Sanitary Commission point out, "that village improve- " ments in water-supply, drainage, cleansing, and jungle clearing, will have to be carried " out before we can expect reduction in fever death-rates."

There were 9,865 deaths registered from bowel complaints, showing a death-rate of 2·20 per 1,000 against 7,825 or 2·06 in 1880. As usual, Sibsagar recorded more deaths under this head than any other district, which the Sanitary Commissioner states may be accounted for by a better and more progressive system of general death registration than has yet been attained elsewhere in the province.

British Burma.

It is satisfactory to learn that the registration of vital statistics in British Burma is gradually improving year by year, and that the attention which has been given to the subject in some of the larger towns of the province has resulted in considerable improvement. The actual number of births and deaths registered was greater than in any previous year, but as the ratios for 1881 have been calculated on the census of that year, which showed that the population under registration had increased by 577,859 since the taking of the previous census, they appear less than those of 1880. The number of births registered during 1881 was 73,754 or 19·98 per 1,000 against 72,121 or 23·16 in the previous year, and the excess of births over deaths equalled 3·57 per 1,000.

The year was considered to have been, on the whole, a prosperous and healthy one; food of all kinds was abundant and moderate in price. The total number of deaths registered was 58,136 or 15·75 per 1,000 against 55,185 or 17·72 in 1880. The highest death-rate recorded in the districts of the province was 28·20 at Thayetmyo, and the lowest, 8·88, at Tharawaddy. The increase of 2,951 deaths was mainly due to cholera, the deaths from which were more than double the number of the previous year, namely, 5,239 or 1·42 per 1,000 against 2,638 or 0·85. Excepting in Kyoukpyoo and Sandoway, cholera was present in every district, but the disease was not very widely diffused, for out of 875 circles, in only 97 were deaths reported, and in 222 villages out of 15,451. The epidemic influence of the disease was principally felt at Thayetmyo, Henzada, and Prome, which respectively recorded death-rates of 7·0, 3·88, and 2·41 per 1,000. The total cholera deaths in these three districts numbered 3,197.

There was a considerable falling off in small-pox deaths of which only 1,766 or 0·48 per 1,000, were recorded against 5,402 or 1·73 in 1880. As was the case in the previous year, all the districts were affected but Tavoy and Mergui. Deaths were reported only in 64 of the registration circles and in 87 villages. Children under one year of age contributed 19·36 per cent. of the fatal cases, and those between one and 12 years 47·22 per cent.

The number of deaths attributed to fevers was 27,743 or 7·51 per 1,000 against 27,297 or 8·86 in 1880. The Sanitary Commissioner believes that a large number of deaths which were really due to other causes are ascribed to fever by the ignorant persons upon whom it is necessary chiefly to rely for the collection of these statistics. He is also of opinion that remittent fevers are more common, and that the ordinary ague or intermittent form is not a very fatal disease among the Burmans. Out of 875 registration circles, 564 recorded fever deaths and 1,436 of the 15,451 villages.

Bowel complaints caused 3,808 deaths, equal to 1·03 per 1,000 of the population, being 308 in excess of the number of the previous year.

IV.—JAILS.

Throughout India during 1881 considerable progress was made in promoting the well-being of the prison population. Special attention was given to the dietary of the prisoners, and the experience of another year, Dr. Cuningham states, has shown that the excessive sickness and mortality of previous years in the Bengal jails was due to other causes than that of insufficient and unsuitable food. Out of an average strength of 100,844, which was nearly 6,000 less than that of 1880, the admissions into hospital were 1,214, the daily sick 44, and the deaths 44·03 per 1,000. The admission and sick rates were slightly below those of the previous year, while the mortality was over 4 per 1,000 less. Sickness and mortality in jails.

The results for the various provinces were as follow:—

Provinces, &c.	1881.			1880.		
	Ratio per 1,000 of Average Strength.			Ratio per 1,000 of Average Strength.		
	Admissions.	Daily Sick.	Deaths.	Admissions.	Daily Sick.	Deaths.
Bengal	1,572	52	65·01	1,542	52	63·82
Madras	737	28	41·91	851	33	44·95
Bombay	1,076	34	41·88	1,150	41	45·16
Punjab	1,519	48	65·15	1,352	42	78·82
North-Western Provinces and Oudh	764	32	28·78	735	31	28·32
Central Provinces	790	29	29·30	973	39	60·13
Berar	826	24	19·51	942	28	35·64
Assam	1,390	40	43·10	1,173	38	52·46
British Burma	883	36	45·82	870	30	24·89

It will be seen from the above table that there was an increased mortality only in the jails of Bengal and British Burma, the remainder showing an improvement in this respect, and in some cases it was very marked. There is no doubt, however, that, excepting in three provinces, the returns are still much in excess of what they ought to be.

Bengal.

The jail population of Bengal in 1881 was lower than in any year since 1872, and this was attributed principally to the continued prosperity of the country, arising from a succession of good harvests and the cheapness of the principal food grains. An improvement in the water-supply by the provision to all jails of standard filters has had a beneficial effect on the health of the prisoners, and the fortnightly system of weighments has proved very valuable to executive as well as medical officers, the weights at once affording an indication when a change of labour or of diet is desirable. On the whole, however, the health returns show no improvement, for there was a slight increase in the admission-rate from 1,542 per 1,000 of average strength in 1880 to 1,572 in 1881; the daily sick, 52 per 1,000, was the same, while the death-rate rose from 63·82 to 65·01 per 1,000. The statistics of the Bengal jails in fact show that sickness, as gauged by the admission and daily sick rates, was more prevalent in 1881 than in any of the previous 10 years, and that the death-rate was also in excess of any year excepting the years 1878 and 1879. With a view to the discovery of the sources of the continued and increasing sickness the Government of India directed that a special committee of duly qualified officials be convened to inquire into the whole subject. Notwithstanding these unfavourable results, it is satisfactory to learn, as the Inspector-General reports, that the majority of the jails have now become very healthy. The total result has, he states, been very considerably affected by the unhealthiness of the jails of Midnapore, Mymensingh, Chumparun, and Julpigoree. There was, however, a very considerable improvement in the health of the prisoners at Alipore and Presidency jails, and as these two jails contain one-fifth of the entire jail population, the improvement is viewed with satisfaction. In the former of these jails the admission-rate for all classes of prisoners in 1881 was 1,960 per 1,000 of average strength against 2,376 in the previous year, and in the latter jail, 1,841 against 1,992.

The chief causes of sickness and mortality were fevers and bowel complaints, and these combined constituted nearly two-thirds of the total admissions and more than half the deaths. Cholera cases increased from 64 in 1880 to 179, and the deaths from 31 to 81.

This disease was chiefly confined to five jails, Midnapore contributing 33 of the total 81 deaths, Chumparun 20, Moorshedabad and Buxa 6 each, and Pubna 5. Respiratory diseases also were slightly more prevalent than in 1880, the admissions having increased from 920 in 1880 to 942, and the deaths from 106 to 107; while, on the other hand, anemia and debility show a decrease both in admissions and in deaths, the latter having fallen from 124 to 100.

Amongst convicts the hospital admission-rate per 1,000 was 1,696 in 1881 against 1,682 in 1880, the daily sick-rate was 54, exactly the same as in 1880, and the death-rate was 68·6 against 65·4. In 24 jails, containing more than half the convict population, the death-rate was lower than the average, and in 23 jails it was higher.

The following jails show the highest death-rates:—

	Death-rates per 1,000.			Death-rates per 1,000.	
	1881.	1880.		1881.	1880.
Julpigoree	285·5	341·2	Monghyr	94·8	53·0
Baraset	208·4	148·4	Burdwan	90·0	61·1
Chumparun	203·8	83·0	Moorshedabad	86·3	49·7
Dinagepore	185·3	181·7	Rajshahye, *District and Central*	83·5	69·5
Mymensingh	166·8	142·8	Rungpore	83·3	111·0
Beerbhoom	152·9	96·0	Manbhoom	80·9	50·3
Midnapore, *District and Central*	126·4	72·9	Hooghly	76·6	43·7
Bogra	124·9	104·3	Jessore	74·5	37·3
Darjeeling	122·4	30·7	Mozufferpore	74·5	69·1
Lohardugga	108·7	193·7	Backergunge	78·2	10·4
Nuddea	105·7	70·9	Bankoora	68·6	60·8
Purneah	98·9	120·0			

As in 1880, the highest death-rate was recorded at Julpigoree. Of the 30 deaths which occurred in this jail, 25 were registered in the first five months of the year, and five in the last seven months. The Inspector-General states that the new jail is fast approaching completion, and it is hoped that this will add materially to the healthiness of the prisoners, inasmuch as under the new arrangements they will sleep on beds raised 14 feet above the ground, and thus to some extent be protected from the influence of malaria.

The jails showing the lowest death-rates were as follow:—

	Death-rate per 1,000.			Death-rate per 1,000.	
	1881.	1880.		1881.	1880.
Chittagong	108·8	16·6	Buxar, *Central*	34·1	41·8
Pooree	11·4	23·9	Patna	39·4	86·0
Furreedpore	14·2	75·6	Maldah	39·8	66·6
Bhagulpore, *Central*	17·3	31·3	Durbhunga	40·4	43·0
Tipperah	21·4	56·5	Shahabad	43·6	34·1
Singbhoom	21·5	88·1	Bhagulpore, *District*	44·1	67·8
Dacca, *District and Central*	22·7	37·8	Pubna	49·7	75·7
Cuttack	23·1	34·4	Presidency, *European*	55·7	29·0
Presidency, *Native*	23·4	31·6	Alipore, *District and Central*	58·2	66·0
Gya	23·7	33·2	Sarun	62·9	47·0
Balasore	25·0	110·8	Russa, *Female Jail*	63·5	46·6
Noakholly	25·0	18·1	Hazaribagh, *District and Central*	63·9	23·3

"The fact," the Inspector General remarks, "that a very large proportion of the "prisoners in the Provinces were confined in these jails shows that, on the whole, the "sanitary conditions of jail life in some of our most important jails have improved very "considerably. It is a matter for congratulation, that 12 jails, in which are included "three central jails, should have a mortality of less than 30 per 1,000 during the "year."

Madras.

Since the famine year, 1877, there has been a gradual improvement in the vital statistics of the jails of the Madras Presidency. In that year the mortality reached 176·01 per 1,000, and in 1881 it declined to 41·91, which was 3 per 1,000 less than in the previous year. The death-rate was, however, nearly 10 per 1,000 higher than the

mean of the five years prior to the famine. The admission and daily sick rates were lower than those of 1880. In 22 jails the mortality was under the average, and in 12 the average was exceeded. The highest death-rate was in the Tanjore jail, where it reached 166 per 1,000. Owing to the persistent unhealthiness of this jail, the construction of a new building has at last been sanctioned. Trichinopoly central jail recorded a mortality of 121·36 per 1,000. Of the 125 deaths (comprising nearly a third of the total number of deaths in the jails of the Presidency) which occurred in this jail, 32 were due to cholera out of a total of 33 from this disease, and 80 to dysentery and diarrhœa. A searching inquiry was made regarding the outbreak of cholera at Trichinopoly, and although no absolute conclusion was arrived at, it was suggested that the jail might have become tainted by the foul air wafted from the filth depôt of the municipality "where acres " of excreta lay exposed on the surface of the ground without being covered or deposited " in pits." The returns of the Salem jail show that there was a marked improvement in the health of the prisoners, the mortality having declined from 146 to 45 per 1,000. There was also a considerable decrease in the mortality in the large central jails at Coimbatore, Vellore, and Rajahmundry, which, it is stated, testifies to the care and attention given to matters connected with the well-being of the prisoners by the authorities.

As regards the convicts, the hospital admissions declined from 9,367 to 7,564, and the deaths from 519 to 419. The greatest number of admissions was due to intermittent fever, dysentery, and diarrhœa. From these last diseases there were 169 deaths, and of cholera there were 33 fatal cases.

Bombay.

There was a considerable decrease in the jail population of the Bombay Presidency in 1881, and with it a proportionate diminution of sickness and mortality. The admissions into hospital were 1,076 per 1,000 against 1,150 in 1880, the daily sick 34 per 1,000 against 41, and the mortality equalled 41·88 per 1,000 against 45·16 in 1880. Compared with the two previous years, 1878 and 1879, the mortality during the year under review, as also that of 1880, was less than one-half. Nearly two-thirds of the total mortality were due to dysentery and diarrhœa, respiratory diseases, fevers, and general debility. Cholera deaths increased from 5 in 1880 to 37 in 1881, and of these 18 occurred in the Surat jail.

The returns of the convicts give an admission-rate of 778 per 1,000, a daily sick-rate of 33, and a death-rate of 43 per 1,000, all of which were below those of the previous year.

Several jails showed an increased mortality, especially those of Satara, Ratnagiri, Surat, Dohad, Karachi, Hyderabad, and Shikarpur, where the mortality ranged from 23 to 139 per 1,000. The highest death-rate, 139 per 1,000, was registered in the Surat jail, but nearly one-half was due to cholera. The next highest was 112·80 per 1,000 in the Gokak Gang, which is a satisfactory improvement on 156·38 in 1880. In the Hyderabad jail the death-rate rose from 54 per 1,000 in 1880 to 69 in 1881, the increase being attributed to the prevalence of fever throughout the district during four months of the year, and to chest and bowel complaints. Next to Hyderabad comes Shikarpur jail with a mortality of 63 per 1,000 against 38 in 1880, an increase which is stated to have been due "to the extreme variations in the temperature of the day and " night, more especially towards early morning, when a bitterly cold wind often comes." At the suggestion of the medical officer of this jail, straw pillows and jungle-grass sleeping-mats instead of date mats have now been issued for greater warmth.

Punjab.

The sanitary history of the Punjab jails for 1881 shows a greater prevalence of sickness than in the previous year, but of a less fatal nature. Among all classes of prisoners the hospital admission-rate rose from 1,352 per 1,000 in 1880 to 1,519; the daily average sick from 42 to 48, while the death-rate fell from 78·82 in 1880 to 65·15 per 1,000. Considering that in 1879 the mortality exceeded 140 per 1,000, this further reduction is satisfactory, the more so as there was a slight increase in the general mortality of the free population. The death-rate among convicts was 66·7 per 1,000 against 81·4 in 1880; but for a severe outbreak of cholera in the Lahore central jail, where 92 prisoners died from this disease, the mortality would have stood at about 59 per 1,000. The diseases from which the convicts principally suffered were fevers, bowel complaints, respiratory diseases, and cholera. Under the two first of these headings, the admissions to hospital were more numerous than in 1880, while the deaths from these diseases were fewer by 89. Altogether there were 133 cases of cholera, of which 97 proved fatal, whereas in 1880 there was only one cholera death.

From respiratory diseases 159 convicts died against 248 in 1880; there was also a very marked decrease in the deaths from ulcers and boils, from 98 in 1880 to 13 in 1881.

The statistics of individual jails show that in 15 the rates of mortality were in excess of those for 1880. In no jail, however, was the terribly high death-rate reached which the Rawalpindi jail recorded in the previous year, namely, over 401 per 1,000. The highest death-rate in 1881 was 265·6 per 1,000 at Dharmsala, which was more than three times as high as that of 1880; the next highest was 201·2 at Rawalpindi, the Lahore and Peshawar jails following with death-rates of 157·4 and 136·9 respectively, against 101·5 and 127·2 in 1880. The high mortality of the Dharmsala jail was due to a severe fever which affected the whole valley. It is reported that the prisoners were received into that jail in such a miserable condition that it was impossible to revive them. Of the 34 deaths in this jail 24 were ascribed to fevers, and 12 of the total number occurred among prisoners who had not been in jail more than two months, and 25 were of less than six months confinement. Every endeavour was made to prevent the spread of disease, but without success, and ultimately the jail was closed until the health of the inmates had been restored. Since the re-opening of the jail it has been healthy. Although the mortality in the Rawalpindi jail was extremely high, the decrease of one-half what it was in 1880 is very satisfactory, and had it not been for the epidemic of fever which extended over from the previous year the decrease would have been still greater. That there has been a considerable improvement in the health of this jail is shown by the fact that 104 of the 131 deaths occurred in the first four months of the year. In the Lahore central jail nearly a third of the mortality resulted from a serious outbreak of cholera, the ravages of which were only checked by the promptitude with which the prisoners were moved into camp. The continuance of typhus fever in Peshawar again told upon the health of that jail. The death-rate was almost identical with that of the previous year; but more than two-thirds of the mortality were from fevers, and occurred in the first five months of the year. After the cessation of this epidemic the jail remained healthy to the close of the year. There was also a very considerable reduction of mortality in the Rupar central jail. In the previous year the death-rate of the jail was 104·17 per 1,000, but in 1881 it declined to 55·74, which was also less than one-fifth of the mortality of 1879. During these three years, the Inspector-General observes, the conditions under which the prisoners existed, as far as prison arrangements go, were the same, and in the face of these facts, he thinks it not unreasonable to attribute the sickness in this and other jails in 1879 to influences independent of prison life. It is satisfactory also to learn that the mortality in the Ferozepore jail, 65·6 per 1,000, was less by one-half what it was in the previous year.

North-Western Provinces and Oudh.

The health of the prisoners in the jails of the North-Western Provinces and Oudh during 1881 was on the whole more satisfactory than in the previous year. Although there was a slight increase of sickness, the rate of mortality was less by about 5 per 1,000 than that of 1880. The ratios per 1,000 of average strength in 1881 were, admissions 764, daily sick 32, and deaths 23·78. Among convicts the admission-rate equalled 797, the daily sick 33, and the death-rate 23·4 per 1,000. In all the jails there was a remarkable exemption from cholera, only two deaths having occurred; on the other hand, bowel complaints were very prevalent, contributing about one-third of the total mortality. No less than 48 per cent. of the deaths occurred among convicts who were in bad or indifferent health on entering the jails, while 22 per cent. of the mortality was due to diseases of no connexion with jail conditions. The prevalence, however, of dysentery and diarrhœa, pneumonia, and cases of sloughing ulcer, the Inspector-General remarks, "still warn us that the sanitary conditions under which the prisoners in certain "jails live are not perfect. The medical officers in charge must feel, as I do, that the "occurrence of such cases is a stigma upon jail management, and we dare not rest "satisfied until the abnormal death-rate in every jail can be proved to arise solely from "the reception of old, broken-down, 'poor-house' cases, and not from disease produced "in strong men in the prime of life simply because they have become inmates of a "jail."

But while the health of the convicts generally was satisfactory, the returns of a few jails witness to a state of things sadly needing attention. At Gorakhpur the mortality reached 139·7 per 1,000, more than a half being due to bowel complaints. This jail, it is stated, is built on a bad site, the garden being flooded by the river Rapti, while a portion of the original building is supposed to have been erected on the site of an old graveyard. A scheme has been sanctioned for sinking in this jail a deep well which will draw water

from a depth at which it will be free from surface impurity. The next highest mortality was at Mirzapore, namely, 70 per 1,000, and the Meerut central prison followed with a ratio of 40. For some time past the condition of this jail has been a source of anxiety, and various schemes for its improvement have from time to time been tried, but still the annual epidemic of malarious fever has recurred. Special attention was being paid to these three jails with a view to their sanitary improvement.

Central Provinces.

In the jails of the Central Provinces the health of the prisoners appears to have been remarkably good in 1881, for the daily average sick-rate was only 29, or nearly 11 per 1,000 less than that of the previous year, while the death-rate decreased from 60·13 in the previous year to 29·30. The number of hospital admissions was low in all the jails without exception; the daily sick and death-rates were also low in most of them. There was not a single case of cholera during the whole year, and in many jails the mortality from the other principal diseases was less than half what it was in 1880. As regards the convicts, the mortality equalled 30·1 per 1,000, against 61·2 in 1880.

Of individual jails, Hoshangabad had the highest death-rate, 71·7 per 1,000, then came Raipur with 59·8 and Narsingpur with 55·6, Damoh and Nimar following with ratios of nearly 50 per 1,000 respectively. A marked improvement took place in the health of the convicts in the Jubbulpore and Nagpur central jails, which was attributed to the improvements effected during the year in the drainage and water-supply. In several other jails improvements under these heads were made during the year, especially in the Raipur jail; but in this instance the diminution of sickness was not nearly so great as in Jubbulpore and Nagpur.

Berar.

The general health of the prisoners in the Berar jails during 1880 appears to have been particularly good. The rates of admission and daily sick were respectively 825 and 24 per 1,000 of average strength against 942 and 33 in 1880, and the death-rate was 16·51 against 35·64. Among convicts the mortality declined from 35·2 in 1880 to 16·1 per 1,000 in the year under notice. Respiratory diseases caused more deaths than any other disease, but they were chiefly confined to the two central jails of Amraoti and Akola, were seven out of the total eight deaths under this head took place. In the previous year there were no cases of cholera in the Berar jails, and in 1880 only three cases occurred, all in the Akola jail, one of which proved fatal. There was more sickness among convicts in the Akola jail than in Amraoti, but the death-rate of the latter was the highest, namely, 17·6 per 1,000, while that of Akola was only 12·9. The highest convict death-rate was 35·3 in the Bassim jail.

Assam.

Although the average daily sick-rate in the Assam jails rose from 38 per 1,000 in 1880 to 40 in 1881, the death-rate fell from 53·1 to 43·1, which was a lower ratio than in either of the preceding four years. This improvement is all the more marked because of the total 63 deaths in 1881, cholera was the cause of 12, whereas in the previous year there was only one fatal case from this disease. Of the remaining deaths fevers caused 9, and 23 were ascribed to bowel complaints. Of the total deaths 58, or 42·7 per 1,000 of average strength, were recorded among convicts. Of all the jails in the province that of Gauhati was again the most unhealthy. This jail has long held an unenviable precedence as regards mortality, and in 1880 it contributed 34 of the total deaths, 10 of which were due to cholera. The death-rate of the Gauhati jail was 110·3 per 1,000. In the Dibrugarh jail also the mortality was high, but considerably less than the previous year, the ratio having fallen from 215 to 115 per 1,000. With these two exceptions the general healthiness of the other jails in Assam was satisfactory. In the large jail at Tezpur the health of the prisoners was particularly good, only two deaths having occurred during the year, and these, it is stated, were in a moribund condition on admission. In Sylhet also, with an average population of over 600, there were only 9 deaths, equal to a death-rate of about 16 per 1,000.

British Burma.

In the jails of British Burma the ratio of sickness among the prisoners was slightly in excess of that of 1880, while the death-rate was nearly twice as high, being 45·82 in 1881, against 24·89 in the previous year. The admission-rate for convicts was 933 per 1,000 of average strength, against 889, and the death-rate 45·1 against 23·4. This increase was due chiefly to the prevalence of epidemics at the Rangoon, Moulmein, Henzada, and Thayetmyo jails. Out of a total of 205 convict deaths, considerably over a half occurred at two jails, Thayetmyo having returned 66 and Moulmein 61. Of the deaths at the latter jail 26 were due to cholera, while at the former there were 51 fatal cases of beri-beri, all of which took place between July and October. Every effort was made

to check the ravages of this epidemic, but without success, until, in the month of October, a large number of prisoners were released and the rest were transferred to Moulmein. This measure proved completely successful, for not a single fresh case occurred after the transference of the prisoners. The facts of this outbreak of beri-beri were carefully investigated by a special committee, but nothing was elicited to show that the disease is contagious, "while the fact that it entirely ceased when the convicts "were removed elsewhere shows," the Government of India observe, "the vast im- "portance of local conditions as a cause of disease, and the great practical benefit to be "derived from a recognition of this truth, and by early removal to another locality."

Fevers caused more sickness than usual during the year, the admissions under this head having increased from 815 in 1880 to 1,180; the excess, however, occurred entirely in the Rangoon jail, where there were 801 fever admissions against 348 in the previous year, but in all there were only ten deaths from these causes. Cholera cases rose from 17 in 1880 to 68 in 1881, and the deaths from 6 to 36, of which 26 took place at Moulmein and 9 at Henzada. There was also an increase in the admissions under dysentery and diarrhœa from 521 in 1880 to 618, and in the deaths from 28 to 47. No death occurred from ulcers in any of the jails during 1881, a fact which is looked upon with satisfaction, being the first year in which this was the case, and showing, the Inspector-General states, "that notwithstanding exceptional disease, the general health "of the prisoners was not bad."

V.—VACCINATION.

Further progress was made in vaccination work in Bengal during 1881–82 by an extension of the operations of the Vaccination Establishment, for the first time, to certain tracts in the districts of Purneah, Maldah, Bhagulpore, Mymensingh, and Pooree, together covering a total area of 6,035 square miles, with a population of 2,070,413, of whom 329,813, or 16 per cent., were vaccinated. In addition, portions of Purneah and Darjeeling, and the entire Sonthal Pergunnahs district were made over to licensed vaccinators. Bengal.

The total number of vaccinations performed by the combined establishments was 1,349,607 against 1,394,312 in 1880-81. In the vaccination circles the operations numbered 1,284,925 against 1,339,012, and in the municipalities and dispensaries 64,882 against 55,300, showing a decrease of 54,087 in the former, and an increase of 9,382 in the latter, or a net decrease of 44,705 cases. The decrease was confined to the Metropolitan, Eastern Bengal, Orissa, and Darjeeling circles, but principally to the Metropolitan, where the falling off was due, it is stated, to certain areas having been repeatedly gone over in previous years by Government vaccinators. The decrement in the other circles was attributed to great sickness among the establishment, to the opposition of the natives, to paucity of vaccinifers, and to other causes. In the Ranchi circle there was an increase of 21,639 operations over the number performed in the previous year, and of 5,994 in the Sonthal Pergunnahs circle.

Of the total vaccinations 1,337,631 were primary cases, 52 per cent. being males and 48 per cent. females, and the ratio of success was 98·39 against 98·23 in 1880. In respect of age, 150,235 children under one year of age were successfully vaccinated, and 831,096 above one and under six years. As was the case in 1880, in no circle was the estimated birth-rate of 30 per 1,000 of population overtaken by the infant vaccination ratio, "nor will this," the Sanitary Commissioner states, "be possible as long as the "people do not generally favour early vaccination, and cease from hiding their children "at the approach of the vaccinators, and there are no birth registers generally kept up "to assist the vaccinators." Of the estimated births in the areas under operation only 11·32 per cent. were vaccinated against 13·94 in 1880. This is the more unsatisfactory, the Lieutenant-Governor points out, because of the total deaths from small-pox 72 per cent. occurred among children.

In the course of their work the Government vaccinators visited 21,929 villages, and inspected 856,628 persons out of the 1,284,925 who had been vaccinated in the different circles. This proportion, compared with the number inspected in the previous year, shows a falling off of 61,421. In addition, sanitary inspections were made by the vaccination officers at a number of villages, but in the majority of the cases the reports submitted were very poor and contained nothing of special value.

The Compulsory Vaccination Act was introduced during the year into the towns of Rungpore, Rampore, Bauleah, Soory, Hooghly and Chinsurah, Pubna, and Bogra, and since the close of the year it had been extended to Howrah. The working of the Act was not attended with any great difficulty, the people in most cases having yielded to simple persuasion, and in the few instances where they proved refractory the issue of a summons was almost always effectual. Generally speaking, vaccination would appear to be making satisfactory progress in Bengal. Opposition, fostered by caste prejudices, is in some places still offered, but as a rule the masses now accept vaccination with readiness and docility, and in some parts it is even sought after and paid for. The law prohibiting inoculation was extended during the year to several towns, and hopes are entertained that before long vaccination will take its place.

In the Madras Presidency 601,222 persons were vaccinated during 1881, being 58,537 less than the number in 1880. Of these 590,875 operations were performed by the special establishment, and 10,347 by medical officers attached to dispensaries. The falling off in the year's work was chiefly due to the great decrease of vaccinations in the Tanjore district, where they fell from 160,979 in 1880 to 44,763, or 116,216 less. A decrease in this district was expected, as in the two previous years almost all the unprotected children were vaccinated by order of the late Collector. The fact, however, that there were 59,770 births in Tanjore during the year, and only 6,712 infants vaccinated, shows that the decrease was greater than it ought to have been. Five other districts also showed a decrease in the number of operations, ranging from over 2,000 to 1,800; still in many instances there was a marked improvement, especially in Coimbatore, where Madras.

vaccination had been very backward, and Madura, the operations in the former district having increased to the extent of 12,192, and in the latter to 11,261. In the Malabar district also there were 7,838 more operations performed than in the previous year. The improvement in these three districts was due to the great interest taken in the spread of vaccination by the divisional officers, and the pressure that was brought to bear by them on heads of villages.

The total primary vaccinations numbered 590,681, of which 91·1 per cent. were successful against 88·72 in 1880. Among children under one year of age there were 98,292 successful operations, representing only 13 per cent. of the registered births; and among children between one and under six years the successful primary cases were 260,565.

Notwithstanding that there was a net increase in the municipalities of 11,008 over the vaccinations of the previous year, vaccination work in most municipalities is still very backward. "In municipalities with a comparatively crowded population," the Inspector-General remarks, "which is to a very great extent independent of the influences for per-"suasion that may be brought to bear on the inhabitants of country villages, compulsory "vaccination is more called for than it is in the rural districts . . . My inspections have "shown me that under the present so-called voluntary vaccination system it is almost "impossible to keep up a supply of good lymph in the smaller municipalities; the "consequence is that much of the vaccination done in them is far from being first rate. "With a good compulsory Act 99 per cent. of it ought to be first rate; then, and not "till then, the people will obtain the full protection from small-pox that vaccination "can give."

Bombay.

Vaccination work in the Bombay Presidency was attended with more satisfactory results in 1881-82 than in the previous year. The total number of persons operated upon was 786,092 against 704,984, showing an increase of 81,108, equal to 11·36 per cent. Of these 749,429 were vaccinated by the special establishment, 29,308 by dispensaries, and the remainder were operated on in the army. The primary vaccinations rose from 642,505 in 1880-81 to 729,323, with a percentage of success of 96·52, the highest ratio yet attained in the Presidency, against 95·95. The percentage of success in primary operations was in all districts higher than in the previous year, and ranged from 98·76 in the Cutch circle, to 74·63 at Aden; the ratio of success per 1,000 of total population also rose from 24·60 to 27·54.

According to age, 463,311 children under one year of age were successfully vaccinated, and 223,343 between one and six years. Exclusive of Native states, there were 384,286 surviving infants available for vaccination during the year, and of these 282,480 or 73·51 per cent. were protected from small-pox. Allowing a rate of 31 per 1,000 on the total population as that of infants available for vaccination, 58·48 per cent. were successfully operated on against 49·27 in 1880-81.

In the course of the year the officers of the Vaccination Department occupied 5,289 encampments, travelled 88,941½ miles in 9,218 days, and inspected 343,652 children, thereby showing that out of every 100 persons vaccinated, 43·72 were inspected against 46·27 in the previous year.

The working of the Bombay Compulsory Vaccination Act continued to make satisfactory progress; and through the Karachi Vaccination Act a great improvement had been effected in the quality of the work, although, owing to many unprotected children above one year of age having been operated on in the previous year, there was a falling off in the total results.

Punjab.

Owing to the amalgamation of the Vaccination with the Sanitary Department in the Punjab, which came into operation in October of 1881, the provincial vaccination establishment, by which operations were formerly carried on, was broken up and district establishments were formed and placed under the immediate superintendence and control of the Civil Surgeons, subject to inspection by special officers of the Sanitary Department. Everywhere, it is stated, district authorities cordially adopted the new plan of operations and the scheme promises to work well. Under the new arrangements, the staff of Native Superintendents and Vaccinators was considerably strengthened, and it is expected that the working of the new department in future years will show a marked improvement over the results hitherto obtained. With a view to secure uniformity with the annual vital statistical returns, the compilation of vaccine returns was changed from the official to the calendar year; no useful comparison can therefore be made between the results of the two years 1880 and 1881. In order, however, to preserve uniformity

with other provinces, the Government of India has since ordered that in future the official year is to be continued.

The aggregate number of vaccinations performed by all establishments in the nine months was 316,574 against 483,763 in the preceding 12 months. The primary operations numbered 280,046, of which 94 per cent. were successful.

North-Western Provinces and Oudh.

In the North-Western Provinces and Oudh there was a marked increase in the amount of vaccination work done in 1881-82 compared with previous years. Altogether 767,259 persons were vaccinated against 729,185 in 1880-81. Of primary cases there were 745,925, of which 684,026 or 91·70 per cent. were successful, being the largest number recorded since 1870. This continued progress is most satisfactory, but that there is still plenty of room for improvement is shown by the fact that while 1,779,473 births were registered during the year, only 302,175 children under one year of age were successfully vaccinated.

In the first circle, comprising the Meerut and Agra divisions and Tehri, there were 183,746 successful primary vaccinations performed against an average of 170,503 for the five previous years. Eight of the 13 districts in this circle showed an increase, and five a diminution of operations; the most conspicuous among the former being Bulandshahr with an increase of 5,497, and among the latter Saharanpur showed a decrease of 2,368 cases. In previous years vaccination had made steady progress in this district, and it is hoped that the falling off will be peculiar to the year.

In the second circle, comprising the Rohilkhand and Oudh divisions, the successful primary operations numbered 257,572 against an average for the five previous years of 218,409. Out of 22 districts only in three was there a falling off in work, Kumaon showing the greatest, namely, 6,030 cases, Budaun 2,245, and Tarai 382. The decrease in Kumaon is to be regretted since this district has invariably recorded the best results. Satisfactory progress was made in all the districts of Oudh, especially in Rae Barelli, where the operations increased from a previous five years' average of 2,308 to 17,409, a result due in a great measure to the assistance to the cause rendered by the Deputy Commissioner and Assistant Commissioner.

In the third circle, comprising the Allahabad, Benares, and Jhansi divisions, the successful primary operations were 27,050 in excess of the average of the five previous years. Out of 16 districts only in four was there a falling off in cases, and these do not call for any special notice. Progress was greatest in the Banda and Hamirpur districts, each showing an increase of over 4,000; good results were also obtained in the new district of Ballia.

In the course of the year the Sanitary Commissioner made numerous inspections. Everywhere he states he found that the children bore proofs of recent or antecedent perfect vaccination, and he considers the work of the vaccinators, as now performed, most satisfactory.

Central Provinces.

Of late years much progress has been made in vaccinating the people of the Central Provinces. During 1881-82 there were 396,782 persons operated upon, against 325,021 in 1880-81, of which 369,651 were the work of the special establishment, and 27,131 that of the dispensaries. The primary cases numbered 387,498, with a percentage of success of 96. Among children under one year of age there were 167,950 successful primary operations, and among those of one and under six years of age there were 169,986. Estimating the annual births at 40 per 1,000, the percentage of infants vaccinated equalled 56·6, against 49·7 in 1880.

In all districts there was an improvement in work as regards the number of operations performed. Twelve out of the 18 districts in the Provinces showed a considerable increase, the foremost being Raipur, where the operations rose from 13,440 in 1880-81 to 33,425. This number, however, was considered small in proportion to the strength of the staff, and the average number of operations performed by each man was smaller than in many other districts of the Provinces.

Generally speaking, there appears to be no serious opposition on the part of the people to vaccination, and even where it is offered the cases are reported to be generally traceable to the want of tact on the part of vaccinators. In some districts the inhabitants are said to be apathetic, receiving vaccination as a matter of course, though not apparently alive to its benefits.

Berar.

Notwithstanding the unfavourable attitude of the people of Berar towards vaccination, there was a considerable increase in the number of operations performed during 1881-82. These rose from 85,799 in 1880-81 to 95,420, showing an increase of 9,621, and compared with the results of 1879-80, the number was greater by 23,240. The total primary

vaccinations performed by all establishments was 95,269, with a percentage of success of 89·8 against 86·7 in 1880.

The highest percentage of success in primary vaccination was obtained in the Wun district, namely, 93·4, and the lowest, 86·7, in Akola. "The standard of success "obtained in primary operations in Berar," the Sanitary Commissioner states, "does not "compare favourably with that for other provinces in India, though it is better than the "results obtained last year. The cause of this cannot be explained other than in the "difficulty experienced by the vaccinators in carrying on arm-to-arm vaccinations. "Mothers object to take their children from one village to another in order to allow of "lymph being taken from the vesicles on the spot, even though offered batta at the rate "of two annas a mile; consequently the vaccinators have to resort to the use of stored "lymph, with the result of a larger number of failures than if liquid lymph from one arm "to another had been used. The persuasive powers of the vaccinators go a very little "way towards overcoming the scruples of the people in this direction."

Much progress was, however, made during the year in infantile vaccination, 50,357 children under one year of age having been successfully operated on, and 33,693 children between one and six years old. Reckoning the births at 40 per 1,000 of population, the percentage of infants successfully vaccinated was 47·9.

During the season an attempt was made to extend the benefits of vaccination amongst the hill people of the Melghat. A first-class vaccinator was attached to the camp of Mr. Ballantyne, Deputy Conservator of Forests, an officer of much influence among these primitive and timid people, for the purpose. The vaccinator met with considerable opposition; in some villages he was driven out by the people, and in others they fled at his approach. He succeeded, however, in vaccinating 1,134 persons, equal to 23·2 per 1,000 of the population, and the percentage of success obtained was 87·4.

Assam.

Vaccination work was more successfully carried on in Assam during 1881–2 than in any previous year. The total number of persons vaccinated was 40,309 against 24,167 in 1880–81. Of these 39,128 were primary operations, 34,698 or 88·67 per cent. being successful against a ratio of 87·61 in the previous year. Besides these there were 5,102 primary vaccinations in the tea districts of the province, of which 4,043 proved successful, so that altogether there were 38,741 successful primary operations, or a total percentage of success of 87·5. An increase in the out-turn of work was to be expected, as during the season the agency of vaccination was augmented from 17 vaccinators to 36, and ex-inoculators from 58 to 96. Still, considering the imperfect means of communication in the province, the sparseness of the population, and the prejudices of the people, the improvement is satisfactory.

The local authorities were doing all in their power to further vaccination, and the Chief Commissioner had signified his intention to grant funds for the purpose if assured that the additional expenditure would produce an adequate return in more and better work being done.

British Burma.

Hitherto the progress of vaccination in British Burma has been very slow. The Burmese being accustomed to inoculation, prefer to adhere to the practice, except when the advantages of vaccination are made very clear to them. Another source of hindrance is reported to be the frequent failure in the quality of lymph supplied from England. In spite of all drawbacks, however, 50,677 operations were performed by the vaccine establishment, being an increase of 5,660 over the number of the previous year, and 39,884 cases were successful, as compared with 34,890. Besides these, 408 vaccinations were performed at the dispensaries, 303 of which were successful. Of children under one year of age, only 7,310 were successfully vaccinated during the year, less than one-tenth of the estimated births.

The inhabitants of the towns were still much opposed to the adoption of the Compulsory Vaccination Act. In the previous year proposals were made by the municipal committees of Rangoon, Akyab, and Toungoo for the extension of the Act to those towns. At the two former towns, the suggestion aroused considerable opposition among the natives; and as it was found that the arrangements in force at Akyab for vaccinating the public were insufficient to afford complete protection, the enforcement of the Act was postponed pending their completion. It was also proposed not to enforce the Act at Rangoon, until the measure had been considered by the recently elected Municipal Committee; while the Tounghoo municipality withdrew their proposal.

VI.—MEDICAL INSTITUTIONS.

Civil Hospitals and Dispensaries.

The work of reorganising the dispensaries of Bengal was vigorously prosecuted in 1881, and resulted in considerable progress. In many instances inquiry into the financial condition and public usefulness of this class of institution has shown that, while many were perfectly able to stand alone without Government aid, on the other hand many were useless as public charities; were regarded with indifference by the people, and existed solely by means of grants from the State, and chiefly for the benefit of the medical officer in charge and a few well-to-do supporters. This is shown by the fact that on the withdrawal of State aid private subscriptions fell off, followed by the collapse and closure of the dispensary. In some cases, however, where the dispensary had become firmly established, and was widely used and appreciated by the public, subscribers readily came forward on the withdrawal of Government aid, and undertook the management and maintenance of the institution. Bengal.

The most important step of progressive work in 1881 was the issue of a new code of rules, prescribing a simple and clearly defined system, by which all dispensaries are divided into three classes, viz.: the first or unaided class; the second or aided class; and the third class consisting of institutions supported entirely by Government. The rules also liberate Government from the obligation of establishing or continuing to support institutions which cannot be shown to be necessary or useful as public charities; and Government is no longer bound, as before, to supply medical officers and European drugs and instruments in every case in which a moderate local subscription may be raised.

During the year State aid was withdrawn from 64 mofussil dispensaries, but of these only 16 were closed, private subscribers having undertaken to make good the loss in the remainder. The number of dispensaries open during the year was 247, and before its close 17 had ceased to exist, so that there remained open at the end of the year 231. The total number of persons treated during the year was 970,978, of whom 23,444 were in-patients and 947,534 out-patients; in 1880 the corresponding numbers were 911,662, 23,567, and 888,095 respectively. Among in-patients the death-rate was 158 per 1,000 against 152 in 1880. Dr. Payne, the Surgeon-General of Bengal, writes: "If there be evidence in 1881 of greater usefulness in the dispensaries, it must be "sought elsewhere than in the figures, and such tests as can be applied do not give "favourable results. Epidemic fever spread over several districts, and cholera was "more prevalent than in the previous year. It cannot be denied that if the dispensaries "had been in any degree recognised by the people as means of relief in sickness, they "would have been in full requisition in 1881, and attendances very largely increased. ". . . . There can be no doubt that if the figures were true throughout, and the "work were genuine, the excess of 1881 would be larger than it has been made to "appear. In some places a clear relation to the public health is established, but this is "not common in remote dispensaries, although medical subordinates habitually adapt "the public health to their figures, when they think the latter will be considered un- "favourable to themselves. It must not be forgotten, however, that in 1881 the "number of dispensaries was gradually reduced, and this, taken with the more careful "scrutiny of records and the widespread sickness, may sanction a hopeful inference "from the larger numbers of sick returned."

The total receipts of the dispensaries during the year amounted to 40,194*l.* against 42,655*l.* in 1880, and the sources from which the income was derived were as follow:—

	£
Government	10,638
Local, municipal, and other funds	9,638
Interest on investments	3,343
Sale of securities and withdrawal of deposits	1,794
European subscriptions	2,002
Native "	12,779

The total expenditure was 37,428*l.*, which fell short of that of 1880 by 2,850*l.*

The public health of Calcutta was less satisfactory during 1881 than in the previous year, the town having suffered very severely from an outbreak of cholera. This necessarily affected the hospitals and the death-rates among patients. The number of

deaths in the town from bowel complaints showed an increase compared with 1880, though not over previous years; and while fever was not more fatal than in 1880, it was much less so than in other years. This Surgeon-General Payne considers worthy of attention, inasmuch as in several districts of Bengal there was great fever mortality, especially in the neighbouring district of Nuddea. The evidence of the hospitals, however, in 1881, was not in accord with that of the general town record, for although the total fever cases under treatment was considerably less than in 1880, chiefly from want of space in the Campbell Hospital, the actual number of deaths was considerably in excess, and the death-rate much higher than in 1880. Dr. Payne considers the hospital death-rate is a truer test of the mortality from fever than that to be deduced from town registers, and having in view the epidemic character of the disease in adjoining districts, he inclines to the opinion that fever in Calcutta was more fatal in 1881 than before.

The following statement shows the number of patients treated in each of the medical institutions of Calcutta:—

Medical Institutions.	1881.				1880.			
	Total Treated.			Died per 1,000 of treated.	Total Treated.			Died per 1,000 of treated.
	In-door.	Out-door.	Total.		In-door.	Out-door.	Total.	
1. Medical College Hospital	5,331	59,085	64,406	129·89	5,089	57,875	62,964	128·58
2. General Hospital	2,263	—	2,263	97·88	3,168	—	3,168	29·10
3. Mayo Hospital and Dispensaries	2,125	183,354	185,479	153·87	2,130	180,257	182,387	143·19
4. Campbell Hospital	6,074	—	6,074	237·4	6,881	—	6,881	230·78
5. Municipal Police Hospital	2,861	—	2,861	13·05	2,723	—	2,723	11·01
Total Calcutta Hospitals	19,124	242,439	261,563	138·31	19,991	238,132	258,123	134·17
6. Howrah General Hospital	1,636	12,511	14,191	102·07	1,557	13,545	14,902	138·18
Grand Total	20,764	254,950	275,714	148·68	21,548	251,477	273,025	138·17

It will be seen from the above table that there was a slight rise in the general death-rate, from 138 to 142 per 1,000; but this was wholly attributable to the greater prevalence of cholera during 1881, the deaths from this disease having risen from 183 in 1880 to 304. Excluding cholera mortality, the excess disappears, leaving a rate of 131 per 1,000, the same ratio as in the previous year. As already remarked, fever cases were fewer, but they were more fatal, the deaths having increased from 330 in 1880 to 365 in 1881. "This greater fatality," the Surgeon-General observes, "fell chiefly on natives "of Calcutta, and did not extend to Howrah, where, however, European cases were "more severe, as they were in the General Hospital of Calcutta. This points to "sailors as the chief sufferers." From respiratory affections the mortality showed but a slight difference compared with the previous year, and the same is true of dysentery and diarrhœa, which caused 913 deaths against 1,004 in 1880.

As regards the financial condition of the Calcutta hospitals, the income for the year amounted to 42,419*l.*, of which Government contributed 26,839*l.*, and the total expenditure, exclusive of the amount invested, was 40,325*l.*

Madras.

In the Madras Presidency the number of civil hospitals and dispensaries rose from 218 in 1880 to 255 in 1881, 38 new institutions having been opened and one abolished. The number of patients treated during the year was 1,449,592 against 1,313,304. Of in-patients there were 37,323, a less number by 1,500 than that of the previous year, which the Surgeon-General ascribed to "the general good health of the population and "to the favourable conditions of existence as regards food supplies and absence of "epidemic disease." On the other hand, there has been a constant rise in the number of out-patients, which is stated to be due to the opening of new institutions (the number being three times as great as in 1877) and the growing popularity of those already established. Among the in-patients there were 2,629 deaths or 70·4 per 1,000 against a death-rate of 83·3 in 1880.

Of the principal diseases under treatment, cholera was remarkably absent for the first nine months of the year. There were, however, indications of an approaching epidemic of the disease in the month of September, the Surgeon-General therefore issued a warning circular calling upon the local authorities to take such active sanitary precautions as were possible to meet it. Altogether 3,310 cases of cholera were under treatment, 180 having occurred among the in-patients, of which 110 proved fatal. Small-pox was less prevalent than in 1880, and fever cases declined from 207,553 to 200,906. "It is "worthy of remark," the Surgeon-General states, "that notwithstanding the addition in "the last 10 years of 60 new centres of medical relief, the number of fever cases "recorded has been steadily diminishing since 1878 and 1879, showing that malarious

"disorders which were so abundant amongst the population after the famine, had been "steadily decreasing with regular seasons and normal rainfall." From bowel complaints there was an increase from 25,967 in 1880 to 28,874, but there was a considerable diminution of mortality under this head among in-patients, the deaths having fallen from 497 to 425. Venereal cases continued to increase, as did also skin diseases and ulcers. Surgical operations were performed during the year to the number of 40,360 against 30,687 in the previous year. The number of major operations was 2,572 against 1,836.

As noted in the last report, the practical administration of dispensaries in the interior, which was formerly in the hands of Deputy Surgeons-General, has now devolved entirely upon Civil Surgeons of districts; and as the duties of inspection and supervision were becoming more and more onerous owing to the great increase in the number of dispensaries, a scheme was under consideration of the Government for affording efficient aid to the Civil Surgeons.

The income of the dispensaries for 1881 was 79,313*l.*, the amount of Government contribution being 27,974*l.* In the previous year the proportion paid by Government was 347*l.* less, the excess being due chiefly to the payment of a proportion of the salaries of medical officers in a greater number of cases. Native donations and subscriptions again fell from 1,498*l.* to 1,272*l.* The total expenditure of the year, including investments, was 78,691*l.*

Bombay. In the Bombay Presidency there were 41 civil hospitals and 146 dispensaries open in 1881 against 43 and 144 respectively in 1880. The total number of medical institutions was therefore the same in both years. The decrease of two in the number of hospitals, and the corresponding increase in the number of dispensaries, were owing to the conversion of the hospitals at Gogha and Alibág into dispensaries. Patients under treatment during the year numbered 1,275,494 against 1,235,455 in 1880. The number of in-door patients in 1881 was 35,679, being an increase of 620 over the previous year. Of this class, 27,073 were cured and 2,913 died, equal to a death-rate of 81 per 1,000, against 74 in 1880.

Over 20 per cent. of the total patients were treated for malarious fevers, which was somewhat less than in 1880. Cholera cases numbered 3,957 against 136 in the previous year, and the admissions from small-pox declined from 115 to 100. For venereal diseases 21,132 patients sought relief, a less number by 2,179 than that of 1880. It is satisfactory to learn that in Bombay Island the admissions on account of these diseases were 717 less than in the previous year. The admissions under dysentery and diarrhœa were slightly more numerous than in 1880, and cases of skin diseases increased from 150,579 to 153,797. Major surgical operations declined from 3,679 to 3,617, while minor cases rose from 62,780 to 67,650.

During his tour of inspection the Surgeon-General visited the three principal hospitals in Bombay, and 23 civil hospitals in different parts of the mofussil. At these he found little to find fault with, and much to be commended in the conduct of the officers whose work came under his personal supervision.

The financial results of the year showed a net income of 93,396*l.* against 93,782*l.* in 1880. The sums contributed by Government amounted to 73,478*l.*, and those from local and municipal funds and miscellaneous receipts to 18,225*l.* The total expenditure was 89,934*l.* against 89,013 in 1880.

Panjab. The number of dispensaries open in the Panjab during 1881 was 185, or one more than in the previous year, and the total number of applicants who sought relief at them was 1,545,808, being 177,379 in excess of 1880. This increase was due chiefly to the great prevalence of fever in certain localities. In the Amritsar district, where, as already stated, a terrible fever raged during the latter part of the year, the number was 56,000 in excess of that registered in 1880. The in-door patients increased from 34,729 in 1880 to 37,011, among whom there were 2,666 deaths, or 72·0 per 1,000, against a ratio of 84·7 in the previous year. In nearly all the principal hospitals and dispensaries more in-door patients were treated than in 1880, the greatest increase occurring at Mayo Hospital (359), Amritsar (160), and Delhi (137). The greatest mortality took place at the Amritsar Civil Hospital, viz., 280·2 per 1,000, Rawalpindi following with 164·7, Delhi with 142·5, and Peshawar with 123·5.

Under almost all diseases there was an increase of patients. Cholera cases rose from 154 in 1880 to 3,234, those due to malarial fever increased to the extent of about 70 per cent., and from respiratory diseases there were 120,905 cases against 115,113; while on the other hand, cases of bowel complaints fell from 72,813 to 62,712, over 10,000 less. Ulcers, as usual, greatly contributed to swell the attendance.

In surgical operations there was a considerable increase, especially in the major cases, which numbered 4,466, or 935 in excess of 1880. This the Lieutenant-Governor viewed with satisfaction as showing the development of surgical proficiency in the ranks of Assistant Surgeons.

The income of the institutions from all sources amounted to 35,272*l.*, being 1,677*l.* more than in the previous year, and the expenditure increased from 32,805*l.* to 34,186*l.*

North-Western Provinces and Oudh.

Eight new dispensaries were open in the North-Western Provinces and Oudh during 1881, leaving 212 at work at the close of the year. The results were highly satisfactory, both in and out-door patients showing a considerable increase compared with the numbers of 1880. The total patients treated numbered 1,591,807 against 1,469,940 in the previous year, of whom 40,977 were in-door, exceeding the number of 1880 by 1,491. The mortality among this class of patients equalled 76·4 per 1,000 against 93·32 in 1880 and 105·8 in 1879.

The increased attendance of patients was most marked under fevers, the cases from which rose from 279,990 in 1880 to 317,416. From syphilis, respiratory diseases, and skin diseases, also, there was an increase of patients, but from cholera the cases fell from 4,482 to 1,253, and spleen diseases from 42,675 to 29,196. A further proof of the usefulness and popularity of these dispensaries is the increase in the number of surgical operations, especially in the major cases, which numbered 8,288, or 639 more than in 1880. Out of these 5,758 were cured and 283 proved fatal. Cataract cases rose from 2,672 to 2,801, of which 1,803 resulted in the restoration of good sight. "A very great amount of good," the Surgeon-General observes, "has thus been done. "A visit to one of the hospitals where this operation is regularly practised by an "experienced officer would convince the most sceptical as to the great value of this "delicate branch of operative surgery." Of minor operations 69,538 were performed, showing an increase of 2,977 over the number of 1880.

The total receipts amounted to 38,774*l.* against 37,595*l.* in 1880, and the expenditure was 36,752*l.* against 36,604.

Central Provinces.

The number of dispensaries in the Central Provinces remained the same as in 1880, viz. 81. At these 8,159 in-patients sought relief during 1881 and 545,516 out-patients. In the previous year the numbers were 7,882 and 501,479 respectively. Altogether there were 44,314 more cases under treatment than in the previous year, and this increase the Surgeon-General attributed in some measure to the greater unhealthiness of the year in some districts and to the prevalence of cholera; "but as the increase," he states, "has taken place in districts which were pronounced to be healthy, and in which cholera "did not prevail to any extent, it may be safely attributed to the greater appreciation of "the benefits to be derived by the people; and to the greater exertions of all concerned "in the management of these institutions." The death-rate of in-door patients was 96·6 per 1,000 against 101·1 in 1880.

Of the chief diseases under treatment, cholera cases increased from 72 to 4,564, of which 2,786 were attended to in the Julpigoree dispensaries. Cases of malarial fever increased to the number of 8,495, ulcers 7,642, respiratory affections 5,892, dysentery and diarrhœa 3,428, and skin diseases 2,168. A satisfactory increase took place in the surgical operations, the major kind having risen from 398 in 1880 to 567, and the minor from 15,856 to 18,111. There is still, however, the Surgeon-General remarks, a great field open to the surgeon for the exercise of his professional skill in these provinces.

The income for the year, excluding cash balances, was 12,214*l.* against 11,122*l.* in 1880, and the total expenditure 10,401*l.* against 9,956*l.*

Berar.

There was an addition of one new dispensary at Berar to the 35 which were open in the previous year, but it was not in operation until the month of July. The admissions to these numbered 157,098 against 162,709 in 1880, showing a decrease of 5,611. The diminution, however, was solely among out-patients, and was confined entirely to the dispensaries of the Akola and Ellichpur districts, the in-door patients having increased from 2,230 in 1880 to 2,280. The death-rate among the in-patients rose from 36 per 1,000 in 1880 to 38 in 1881.

In the previous year there was only one case of cholera recorded, but in 1881 there were 980; of these 588 were treated in the Akola dispensaries and 139 in those of the Buldana district. Fever cases were less numerous, as were also those of skin and venereal diseases; but, as might be expected with cholera in the province, there was an increase in cases of bowel complaints. The number of operations performed in the

course of the year was 6,708, of which 259 were major. Compared with the numbers of 1880, there was an increase of 20 major and of 209 minor operations.

There was an increased attendance of children at the dispensaries during the year, and this the Surgeon-General considered satisfactory, as tending to prove that the prejudices against European treatment were gradually dying out. Mothers more readily sought the aid of Hospital Assistants in their children's ailments in preference to the village hakims.

The income of the Berar dispensaries for the year was 10,273*l.* against 9,017*l.* in 1880, and the expenditure was 9,262*l.* against 8,497*l.*

Assam.

No new dispensary was opened in Assam during 1881, the number (23) remaining the same as in the previous year; but the statistics of two missionary dispensaries were added to the returns. A total of 58,001 patients were under treatment against 44,428 in 1880, the in-door patients numbering 2,853 against 2,665. This increase in in-patients is satisfactory, inasmuch as the number for 1880 was 418 less than that of 1879. The Chief Commissioner was of opinion that this falling-off was due to the want of confidence felt by the people in the professional assistance and advice offered them, not a single officer of the rank of Assistant-Surgeon being attached to any dispensary; he therefore brought the matter to the notice of the Deputy Surgeon-General. After carefully considering the subject, that officer has come to the conclusion that, except in very few instances, little or no advantage would be gained by the population at large in the employment of Assistant-Surgeons, as the scope for the work of such officers was very limited. The small attendance of in-patients, he states, is "not so much the want of "professional skill as it is the absence of pauperism among the Assamese population, "the rarity of diseases requiring surgical skill which fill the dispensaries in other "provinces, and, hitherto, the poor and unsuitable accommodation which our poorly "endowed dispensaries have afforded."

Of the diseases under treatment there were 149 cases of cholera, a greater number by 59 than in 1880; fever cases increased from 8,380 to 9,481, and bowel complaints fell from 3,726 to 3,524. Skin diseases caused 8,849 admissions, 2,906 of which, or nearly one-third, were treated in the Sylhet district. Surgical operations numbered 2,131, being an increase of 516 over the previous year; the increase, however, was in the minor kind, as the major operations fell from 93 in 1880 to 77.

The income of the Assam dispensaries amounted to 3,771*l.*, and the expenditure to 3,754*l.* against 3,833*l.* and 3,022*l.* respectively in 1880.

British Burma.

Year by year the popularity of the dispensaries in British Burma continues to increase. The number open in 1881 was the same as in the previous year, viz. 27. At these 121,798 patients applied for relief, being 13,016 in excess of the number of 1880. Considering that very few of the medical officers possess more than an elementary knowledge of the Burmese language, the Chief Commissioner thinks the progress made by the dispensaries is remarkable. "Efforts are being made," he states, "to train up natives "of the country for civil medical employment in this province, and Civil Surgeons are "now required to pass an examination in Burmese. It may be expected that these "measures will lead to a wider appreciation of the advantages of the European system of "medicine among the Burmese." There was a slight falling off in in-patients from 10,262 in 1880 to 9,886, but the deaths rose from 737 to 912.

Under malarial fever there were 18,632 cases, a less number by 228 than that of 1880. Cholera cases fell from 183 to 136, and small-pox from 184 to 148. The admissions from wounds and injuries also increased from 6,591 to 7,875. During the year 2,870 operations were performed, 116 being major and 2,754 minor, showing a decrease of 331 major and an increase of 851 minor operations over those performed in 1880; still the total increase showed that European surgery was becoming more valued than heretofore.

The year's income of the dispensaries, excluding cash balances, was 14,961*l.*, and the expenditure 13,073*l.*, 44 per cent. being met by provincial funds.

Lock Hospitals.

Bengal.

After considering the report of the Committee specially appointed to inquire into the working of the Contagious Diseases Act in the town and suburbs of Calcutta, the Government of India declined to render the law regarding such diseases more effectual; it was therefore considered hopeless to attempt to work the Act with any effect for the

protection of the civil population, and it was decided to restrict its limits to that part of the town and suburbs inhabited by women who receive visits from soldiers, and to confine its operation to the protection of the military alone. With this change, which took place on the 1st November 1881, the number of registered women immediately fell from 6,565 to 1,961. Throughout the first ten months of the year the Commissioner of Police states that the number of women on the registers had been steadily decreasing from 7,001 to 6,565, while the state of affairs was even less satisfactory than the figures show. Not only is it estimated that at least one-third of the women practising common prostitution were not on the registers, but even the two-thirds that remained under control were only kept on the registers by their ignorance or weakness, or by the belief that the police were possessed of more power of coercing them than they really had. The Commissioner believed, however, that in future the number of women on the register would rather increase than decrease any further, owing to the fear which prostitutes have to receive soldiers without being registered.

The new registrations for the year numbered 131; of these 111 were voluntary, and only 26 were registered after arrest, as against 682 and 57 respectively in 1880. The number of defaulters fell from 4,993 to 4,934, and the percentage of arrests also fell from 83·3 to 64·30, while cases of disease among the defaulters decreased from 12·2 to 9·4, and this notwithstanding the fact that disease was brought into the town extensively during the year by the garrison, and that the port was uncommonly full of shipping. Among the newly-registered women, 29 per cent. were found to be diseased, against 26·9 in 1880.

Since 1870 the serious cases of disease amongst the registered women had been steadily decreasing. In that year the number was 1,708, but in 1880 they had fallen to 83, and in 1881 to 76.

Among the garrison troops venereal cases of all kinds declined from 12·8 per cent. of average strength in 1880 to 8·7 in 1881; but of primary syphilis the cases rose from 1·7 to 3·1 per cent.

The general results of the working of the four cantonment lock hospitals in Bengal during 1881 were on the whole more satisfactory than those of the previous year. In Dinapore particularly a considerable degree of success was obtained, the proportion per 1,000 of cases of venereal disease among the troops being lower than in any of the previous six years. There was also a decrease of disease at Barrackpore; but at Dum Dum and Darjeeling the results were not so favourable as in 1880.

At Dinapore there was a falling off in the total admissions of soldiers into hospital on account of venereal diseases from 244 or 271·5 per 1,000 of strength in 1880 to 146 or 112 per 1,000 in 1881. This great decrease was attributed to three causes, namely, the careful inquiries and examination of women by the new matrons, the increased activity of the police in working the lock-hospital rules, and in the greater readiness shown by brothel-keepers in sending women to hospital, owing to so few being there at the expense of the State. The registered women increased from 74 at the beginning of the year to 78 at its close. Among these there were 183 admissions into hospital against 207 in the previous year. From primary syphilis and gonorrhœa, the admissions among registered women numbered 139, the same as in 1880; a fact which, the Superintendent observes, "further confirms the view that the great decrease in disease among the "European troops has been caused by the disease being early detected and brought to "hospital for treatment, and not from a smaller amount of disease being present."

The working of the lock hospital rules in the cantonment of Barrackpore during 1881, though showing an improvement compared with the previous year, was nevertheless unsatisfactory. Among the troops there were 87 admissions from venereal diseases or 305·26 per 1,000 of strength against 355·76 in 1880. At the beginning of 1881 there were 89 women on the register, and to these were added 15, but in the course of the year 61 names were removed, leaving only 43 on the rolls at its close. This great diminution was due to a number of kept women being struck off the list. The number of admissions to hospital among the women fell from 159 in 1880 to 96, of which only 28 cases were reported as having been of a specific infecting character, while in 1880 there were 48 such cases.

At Dum Dum there were 139 cases of disease among the troops, equal to 263·93 per 1,000 of strength, against 118 or 270·67 in 1880. Of these 139 cases, 82 were contracted at other stations, chiefly at Calcutta and Benares. During the year 49 women were on the register, but before its close 15 names were removed. On examination 48 women were found to be diseased and were admitted into hospital, being one less than in the previous year. It is satisfactory to learn that the disease from

which the prostitutes and the troops had suffered was of the mildest type. The medical officer feared that the advantages afforded by the new Army Discipline Act to the soldiers for concealing their disease when contracted, would render the Contagious Diseases Act useless, as men might thus come to hospital or not as it suited their convenience. The Lieutenant-Governor, however, instances Dinapore, where, the Surgeon-Major reports, no difficulty was experienced in getting the men to go to hospital of their own accord.

The number of cases of venereal affections among the troops stationed at Darjeeling in 1881 was 68 or 284·5 per 1,000 of strength against 49 or 206·28 in 1880. Of registered women, there were four at the beginning of the year and 10 at its close, and among them there were 18 admissions to hospital. These figures, the Lieutenant-Governor states, "show that unlicensed prostitution prevails very largely. This unfortunately seems "unavoidable under the special circumstances of the depôt. It is quite impossible "to bring the prostitutes in the bazaars at Darjeeling and Jore bungalow under the "Act, and so long as the men have ready access to these, there is little chance of "stamping out or checking the disease."

Madras.

As in 1880, there were seven military lock hospitals open in the Madras Presidency in 1881; these were situated at the stations of Bangalore, Bellary, Cannanore, Kamptee, St. Thomas's Mount, Secunderabad, and Wellington. At all these stations, except Secunderabad, there were fewer women on the register than in the previous year, while the number under treatment in hospital was 2,489, or one in excess of 1880, and the average daily sick declined from 189·64 to 154·24. Amongst British troops, the rate of admissions on account of venereal diseases fell from 324·09 per 1,000 of strength in 1880 to 239·47. There was less disease among troops at all the above stations than in the previous year, and it is satisfactory to learn that cases of primary syphilis, the most destructive of all venereal complaints, were less frequent. Bellary and Bangalore headed the list with admission-rates of 397·75 and 316·05 respectively. It appears that these two stations were acquiring a bad pre-eminence, for in 1879 Bangalore had the highest admission-rate of any station, and in 1880 it stood third, while Bellary was second in 1879, and in each of the two following years its admission-rate has been considerably in excess of that of any other station. "Whether the excessive amount of disability from "venereal diseases at these two stations," the Surgeon-General states, "be due to an "unusual prevalence of these amongst the local civil population, or to exceptional "facilities for clandestine prostitution, or to both causes combined, it is impossible to "say. The efficiency or otherwise of registration does not appear to have any uniform "effect on the prevalence of disease. Thus, at all the stations except Secunderabad, "there were fewer names on the roll in 1881 than in 1880, and therefore presumably "more women at large, and yet the foregoing figures show that venereal disease "declined. In fact, this is only what might be expected, seeing that the Contagious "Diseases Act does not in any town practically reach more than a small fraction of "the women actually amenable to its rules."

Bombay.

In the Bombay Presidency the rules for the prevention of venereal disease were steadily enforced during 1881, and supervision on the part of the police in detecting illicit prostitution was vigilently exercised. At the 12 stations in which lock hospitals were in operation the total admission-rate for venereal disease was 235·60 per 1,000 against 265·53 in 1880. According to the report of the Surgeon-General, the ratios ranged from 44 per 1,000 of average strength at Karachi and 66 at Aden to 290 at Ahmedabad. The results were not so favourable at several stations where there were no lock hospitals, for at Satara, where, however, the number of European troops was very small, the admission-rate on account of venereal diseases was over 700 per 1,000, and at Kolhapur over 350. In consequence of the great prevalence and acute form of venereal disease among the troops at Satara, and on the alleged ground that the success of lock hospitals in the Bombay Presidency had been generally established, the sanction of the Government of India was solicited to the extention of the Contagious Diseases Act to that station. After duly considering the matter, the Governor-General in Council was not satisfied that the lock hospital system in the cantonments of the Bombay Presidency had proved a success, but considered, on the other hand, that in all Presidencies it had been unsuccessful. He did not think it desirable, therefore, to sanction its extension to Satara.

North-Western Provinces and Oudh.

Amongst the troops stationed in the North-Western Provinces and Oudh in 1881 there were 3,340 cases of venereal disease, equal to 231·6 per 1,000 of strength, against

262·8 in 1880, and 240·6, the mean of the preceding five years, and 278·2 the mean ratio of five years previous to the opening of lock-hospitals. The results of the year, therefore, compare favourably with those of previous years. But for the unexpected prevalence of disease at the stations of Moradabad and Sitapur, where the ratios of admissions reached as high as 450·7 and 407·9 respectively, the Sanitary Commissioner is of opinion that the year would have been one of success as regards lock hospital management. In previous years the ratios at these two stations were much more favourable, their means for the five years ending 1880 having been 280·2 and 275·2 per 1,000. Seeing, however, that the average daily strength of the European garrison rose from 9,954 in 1880 to 14,411 in 1881, some credit is due to the general management. In the case of Moradabad, the high ratio is ascribed to the lock hospital being situated in the city, so that no proper control can be exercised over the women; and at Sitapur the prevalence of disease was attributed to the excess indulged in by troops after their return from the Afghan war with an unaccustomed amount of money to spend.

The total number of prostitutes registered in the 18 lock hospitals which were open during the year was 1,756, or 29 less than in 1880, the monthly average on the register being 1,145 against 1,152. During the last four years there had been a persistent falling off in the strength of registered women, which the Sanitary Commissioner thinks is becoming a serious hindrance to the expectation of success in regard to this scheme of disease prevention. The decline in 1881 is looked upon as the more serious because of the rise in the strength of the garrison. The number of women, the Sanitary Commissioner points out, should at least equal a ratio of 10 per cent. of the garrison, consequently there should have been a monthly average of 1,437 instead of 1,152. A greater amount of venereal disease was discovered amongst the registered women than in 1880, the total admissions to hospital being 3,334 against 3,125, and in all stations the ratio of contagious disease prevalence was high.

Central Provinces.

At the four lock hospitals in the Central Provinces, namely, Pachmari, Saugor, Kamptee, and Jubbulpore, the statistics for 1881 show that the working of those at Pachmari and Kamptee were fairly successful, while at Saugor and Jubbulpore there was a great increase of venereal disease among the troops, with a slight increase among the registered women. The average number of prostitutes on the registers during the year was 197, or 14 less than in 1880; the average number attending periodical examinations fell from 173 in 1880 to 153, and the number found diseased and admitted into hospital was 385 against 400.

At Pachmari the ratio of admissions to hospital among the troops per 1,000 of strength was 74·76; at Saugor 140; at Kamptee there was a slight increase in the admissions, but a relative decrease as regards the strength of the troops from 162 per 1,000 in 1880 to 145. The admissions at Jubbulpore rose from 117 or 326 per 1,000 of strength to 232 or 477 per 1,000. The greater number of cases at this station occurred at the beginning of the year, and were contracted chiefly by troops on the line of march, or imported from outside the station. Disease showed a steady decline during the second half of the year.

British Burma.

There are now six lock hospitals in British Burma, but only in the neighbourhood of three, namely, Rangoon, Thayetmyo, and Tounghoo were British troops stationed in 1881. At these the admissions for venereal diseases of all forms numbered 331, or 121 per 1,000 of an average strength of 2,646 against 306 or 115 per 1,000 in 1880. The ratio of cases contracted in the province was 102 per 1,000 of strength against 86 in the previous year. At Rangoon there was a satisfactory decrease both in the amount and in the virulence of the disease, the admissions having declined from 153 or 217 per 1,000 to 108 or 164 per 1,000, while at Thayetmyo they rose from 115 or 82·50 per 1,000 to 140 or 92·20, and at Tounghoo from 38 or 81·37 per 1,000 to 83 or 176·55. This great increase at the latter station was attributed partly to the escape of two diseased women from the lock hospital in November, and who evaded arrest for a period of 20 days. In the following month the number of cases of primary syphilis among the troops was greater than the total for the previous 11 months.

The total number of women whose names were borne on the registers of the several lock hospitals was 911 against 1,048 in 1880, the cases of disease among them being 1,218 against 1,454. At all the hospitals, with the exception of Tounghoo, there was a decrease in the admissions, but there the cases under treatment rose from 21 to 73; the greater number, however, were of diseases which were not specific.

Lunatic Asylums.

In 1876 orders were issued by the Government of India restricting the admission of patients into lunatic asylums to criminal lunatics and to such others as were absolutely dangerous, or were without friends or resources, and yet required medical treatment for their recovery. Since that year there has been a steady decline in the number of patients confined in the Bengal asylums, and it would seem that there is little hope of further reduction. The statistics of the three years ending 1881 certainly point to this conclusion, for though the fresh admissions fell from 196 in 1878 to 173 in 1879, there was an increase of 10 in 1880 and a further increase of five in 1881. The new admissions for the year under review numbered 188, and the re-admissions 25, making a total of 213 admissions during 1881. Bengal.

The aggregate number of persons treated for insanity at the five asylums in Bengal in 1881 was 1,094, less by 10 than the number of the previous year. Of these 93 were discharged on recovery against 73 in 1880, the increase being attributed to the large number of persons admitted who were suffering from acute or curable mania. The most frequent cause of insanity amongst those admitted was excessive use of intoxicating liquors or drugs, as is shown by the fact that out of 111 admissions in which the cause of insanity was known, 66 were said to be due to ganja, 3 to bhang or charas, 13 to spirits, and 2 to opium.

Since 1878 there has been a gradual and satisfactory improvement in the health of the lunatics, the number under treatment in hospital having fallen from 784 in that year to 417 in 1881, which was a less number by 99 than that of 1880. Not a single case of cholera occurred in any of the asylums, while in the previous year there were 12; admissions from dysentery and diarrhœa also fell from 178 to 111, and anemia and debility from 47 to 25. The decrease under this last head would seem to bear out the remarks of the Surgeon-General in his report for 1880, wherein he stated "it is probable "that under the regular practice of *post-mortem* examinations the virgin names of "debility and anemia will appear less frequently in asylum returns." On the other hand, fever cases rose from 123 in 1880 to 136, the principal increase having occurred in the Patna and Dacca asylums, where there were respectively 66 and 49 admissions from this cause against 37 and 30 in 1880. Cases of phthisis rose from 34 to 37 and of pneumonia from 5 to 9.

As regards mortality in the asylums, the number of deaths fell from 109 or 12·3 per cent. of the daily average strength in 1880 to 84 or 9·6 per cent., which was the lowest number in the decade excepting that of 1877. Phthisis caused more deaths than any other disease, namely, 28, dysentery and diarrhœa following with 20, and anemia with 5. As usual, the deaths were most numerous in the Dullunda asylum, where they numbered 33, Patna coming next with 30. The heavy mortality in these two asylums was attributed partly to the condition in which lunatics were received during the year and partly to the larger proportion of maniacs to the total number of patients in them, maniacal affections being considered more fatal than any other form of insanity.

Of criminal lunatics there were 380 under treatment during the year against 369 in 1880, the primary admissions numbering 72. At the close of the year the number was reduced to 297, 24 having died and 59 having been discharged or transferred to their friends.

The results of the working of the three lunatic asylums in the Madras Presidency for 1881 show that there were 175 civil patients admitted during that year, which, added to the number remaining from the previous year, brought the total up to 538, against 512. Besides these 28 criminal lunatics were admitted during the year against 33 in 1880, making a total of this class of 91 under treatment. Of the total cases 131 were said to have originated from physical and 57 from moral causes, a large proportion of the former being attributed to the abuse of narcotics. Cures were effected to the number of 66, and 24 patients were transferred to their friends. Madras.

The general health of the inmates of the asylums was on the whole satisfactory. The admissions into hospital declined from 302 to 261, and the daily average sick from 38·82 to 21·57. Altogether there were 34 deaths, equal to 9 per cent. of the daily average strength, as against 45 or 12·81 in 1881. Of the 34 deaths, 17 were ascribed to dysentery and diarrhœa and 6 to phthisis. The mortality was highest in the Waltair Asylum, being in the ratio 34·5 per cent. to daily strength; in the Madras and Calicut Asylums the death-rate was only 6·01 and 8·3 per cent. respectively. The heavy death-rate at Waltair, though lower by .5 per cent. than that of the previous year, was again attributed by the Medical Officer to the fact that only a small number of hopeless and incurable cases were detained in the asylum. As, however, the average rate since 1878–9 was nearly double that of the seven preceding years the Madras

Government ordered that a strict inquiry should be instituted with a view to ascertain whether in addition to the cause assigned there were special local causes at work.

Bombay.

At the five lunatic asylums in the Bombay Presidency, there were 252 new admissions during 1881, and five re-admissions, making a total of 903 persons under treatment against 913 in 1880. Of these 223 were discharged during the year, 67 as cured, and 154 for transference to their friends. Of the total cases, the alleged cause of insanity was given in 416, of which 350 were ascribed to physical and 66 to moral causes. Among the former 178 were said to have been due to intoxicating liquors and drugs, while of the latter 45 were due to grief.

Though not so good as in the previous year, the general health of the inmates of the asylums was satisfactory, excepting at Ahmedabad, where cholera and fever were very prevalent. There were 327 admissions into hospital against 275 in 1880. Malarious fevers were the chief causes of sickness, the cases numbering 121; bowel complaints came next with 51, debility following with 36, and bronchitis and cholera with 14 and 12 cases respectively. The total number of deaths was 53 or 8·4 per cent. of the daily average strength against 37 or 6 per cent. in 1880. Six of the deaths were due to cholera, all having occurred at Ahmedabad; 11 deaths were recorded as being due to diarrhœa, the same number to debility, and 5 to malarious fevers.

At the end of 1880 there remained 90 criminal lunatics in the asylums, these were increased during the year to 110 by 20 new admissions. Of the total number, which was 5 in excess of the previous year, 9 died and 8 were cured.

Punjab.

The new admissions into the two lunatic asylums of the Punjab rose from 87 in 1880 to 132, increasing the number of patients under treatment in 1881 to 438, of whom 333 were confined at Lahore and 105 at Delhi. Of the primary admissions, 14 were criminal lunatics, and at the end of the year there were 39 of this class in confinement. As regards the health of the inmates of these two asylums there was a slight increase of sickness with a considerable excess of mortality. The death-rate per cent. of daily average strength was nearly the same in both asylums, being 14·60 at Lahore, and 14·98 at Delhi. The chief death cause at Lahore was cholera, which accounted for 13 out of the total 35 deaths. But for this outbreak of cholera the death-rate of this asylum would have compared favourably with former years. At Delhi the chief causes of mortality were diarrhœa and pneumonia, each of which contributed 4 to the total 11 deaths.

North-Western Provinces and Oudh.

The population of the four lunatic asylums in the North-Western Provinces and Oudh for 1881 was 1,154 against 1,093 in 1880. The number admitted during the year was 329, and of these 144 were reported to have become insane from physical, and 19 from moral causes. Before the close of the year 302 persons were struck off the registers, 142 having been discharged as cured, 58 were made over to their friends, and 73 died. In the previous year 76 deaths were registered. The largest number of deaths (28) occurred at the Bareilly Asylum, but the rate of mortality was highest at Agra, namely, 9·44 per cent., and was attributed to the want of a sufficient supply of anti-scorbutic vegetables and fruits. At the Bareilly, Benares, and Lucknow Asylums great care was taken to secure at all time the best vegetables in season, which, supplemented with lime-juice and fruits, proved of great benefit to the health of the inmates.

During the three years ending 1880 there had been a steady decline in the number of criminal lunatics, but in 1881 they began to increase again, rising from 168 in 1880 to 202.

Central Provinces.

At the two lunatic asylums in the Central Provinces, namely, Nagpur and Jubbulpore, the number of patients under treatment in 1881 was 128 and 154 respectively. At Nagpur there were 15 fresh admissions during the year, and 29 at Jubbulpore, and at the former 7 patients were discharged during the year as cured, and 10 at the latter. At both institutions there was a considerable increase in sickness, but especially at Nagpur, where there were 136 admissions to hospital, 56 of which were due to fevers. At Jubbulpore the admissions to hospital numbered 86, fevers accounting for 41. Mortality was heaviest at Jubbulpore, where the deaths rose from 7 in 1880 to 9, 5 of whom, it is stated, were helpless idiots, and had been a long time in the asylum. Nagpur Asylum recorded 6 deaths against 9 in the previous year.

Berar.

The statistics of the Amraoti Lunatic Asylum for 1881 show that the population rose from 31 in 1880 to 34, six being primary admissions, and three re-admissions. The

health of the inmates was very satisfactory, the daily average sick being 1·39 against 2·14 in 1880 and 3·02 in 1879. There were, however, two deaths, while in the previous year the asylum was free from mortality. Of the total cases, the cause of insanity was known only in 16, of which 11 were ascribed to intoxicating liquors and drugs, 3 to epilepsy, and 2 to grief. The number of criminal lunatics under treatment was 9 against 8 in the previous year.

Assam. At the Tezpur Lunatic Asylum in Assam there were, during 1881, 70 patients under treatment, being a larger number than in any previous year. Of an average population of 51·64, there were 73 admissions into hospital against 33 admissions out of a population of 45·85 in 1880. The chief causes of sickness were fevers, lung diseases, and bowel complaints. No less than 38 of the admissions to hospital took place during the last three months of the year, and were due chiefly to fever and diseases of the respiratory system. Seven deaths occurred in the course of the year, being the same number as in 1880, of these 5 were attributed to chest affections. The death-rate was 13·55 per cent. of the daily average strength, against 15·26 in the previous year. Of the 7 deaths, 3 were of persons admitted during the year in a broken-down state of health, the remaining 4 were inmates of previous years with debilitated and diseased constitutions.

British Burma. The total number of persons treated for insanity in the Rangoon Lunatic Asylum during 1881 was 224, or one less than in the previous year. Of these, 48 were new admissions, 11 of whom owed their insanity to physical, and 16 to moral causes. The health of the population was not so satisfactory as in previous years, entirely owing to a severe outbreak of cholera. Admissions to hospital increased from 57 in 1880 to 89, and the deaths from 19 to 25. Cholera was the cause of 31 of the admissions and 12 of the deaths. For the first 10 months of the year the general health of the patients was satisfactory, and the deaths up to the 18th of November numbered only 12. On that date, however, the first cholera case occurred, and notwithstanding that every precaution was taken to guard against the spreading of the disease, not a single ward escaped. In consequence of this epidemic the Superintendent submitted certain proposals for improving the sanitary condition of the asylum, which were approved by the Chief Commissioner. In the previous year cholera was absent from the asylum. But for its appearance in 1881 the Superintendent considered that in no period of its history had the asylum shown so well.

Medical Schools.

Bengal. Medical students in Bengal again decreased in number during 1881–82. At the Calcutta Medical College the number of students declined from 123 in 1880–81 to 117. During the session 115 students were admitted, and at its close 15 passed the M.B. or L.M.S. examination, and 14 hospital apprentices passed and left for regimental duties; of the remainder, 84 ceased to attend, five hospital apprentices were discharged, and one resigned the service.

In the four vernacular medical schools the pupils declined from 503 to 310. The largest reduction occurred in the Sealdah or Campbell Medical School, where, on account of the higher standard of admission enforced for the purpose of securing a better class of practitioners, the number of pupils fell from 244 to 149. Of 35 second-year students at this school who presented themselves for examination all but four passed; and of 47 students at the final examination, 44 or over 93 per cent. were successful against 76 per cent. in the previous year. The Dacca College showed an increase from 87 to 97 in the number of students, and the result of the examinations show that 14 out of 18 third-year class students passed and obtained certificates. The number of students on the rolls of the Temple Medical School during the session was 131, of whom three were military and the rest civil. Of the former, two passed the junior examination; and of the latter, 19 passed the final, and 32 the junior examination. At the Cuttack Medical School there were 30 students against 26 in the previous session. Eleven candidates out of 13 passed for the first diploma, and 5 out of 7 passed for the final diploma. There were again great fluctuations in the number of paying students at these colleges, but as henceforth the fees were to be paid in advance, more regular attendance was anticipated.

Madras. On the opening of the session of 1881–82, the number of students in the three departments of the Madras Medical College aggregated 226, besides six ladies. On the whole the behaviour of the students was satisfactory, and the progress made by them highly

commendatory, as the results of the examinations testify. In the first or senior department there were 82 students against 62 in the previous session. Of these, 20 presented themselves for examination and only two failed. In this department one lady was qualifying for the degree of Licentiate of Medicine and Surgery, and made considerable progress in her studies, having obtained 72 per cent. of aggregate marks at the Professor's examinations. In the second department, consisting of three classes, there were 67 students against 80 in the previous year. Of these, 31 in the third-year class or final year of study, appeared for examination in the apothecary trade, and 29 were pronounced qualified for the public service. The second and first year classes were, with few exceptions, making satisfactory progress. Five lady students were on the rolls of the first-year class of this department qualifying for certificates as medical practitioners, and obtained an average of 73 per cent. of the total marks at the examinations held at the close of the year. In the junior department the number of students increased from 46 in the session of 1880-81 to 77. There were 40 pupils in the third-year class, 30 of whom at the final examination were considered competent to enter upon their duties as hospital assistants. Favourable mention was made of most of the students in the other two classes of this department.

Bombay.

At the Grant Medical College in Bombay there were 283 students on the rolls, being one more than in the previous year. The results of the session were very satisfactory. Five students obtained certificates with the view of prosecuting their studies in England, 23 out of 40 students passed the first L.M. and S. examinations, 4 being in the first and 19 in the second class. In the hospital apprentice class 9 candidates passed the final examination; and 2 female students of midwifery, on finishing their course of study, were found duly qualified for the usual certificates.

In the Medical Schools at Poona and Ahmedabad satisfactory progress was made by the students, of whom there were 60 and 57 respectively on the rolls. The Poona School was called upon during the year for a second time to relieve a sudden strain on the subordinate medical department, and 15 students were found qualified to enter the service. The question of increasing the number of medical subordinates to meet urgent departmental wants was under the consideration of the Government.

The new medical school at Hyderabad was established in July 1881, and its progress is reported to be most encouraging. The Surgeon-General had little doubt that in time the school would take just as high a place as the institutions at Poona and Ahmedabad. The school meets a great want, and will, he says, "in time help the department out "of the difficulty which is at present felt in supplying the Province of Sind with "properly qualified subordinates."

Central Provinces.

In the Nagpur Medical School, Central Provinces, there were 29 students under instruction during the session of 1881-82. Of these 3 were in their third year, 13 in their second, and 13 in their first year of study. All the third-year students passed out of the school creditably, while the remaining students, who had been chosen from the successful competitors at the High School examinations, worked with great assiduity and gained excellent marks at the examinations. The session therefore closed with 26 students on the rolls of the school, but 10 other probationers were to have been added in June 1882.

VII.—SANITATION.

Organisation of Health Departments.

It was stated in last year's report that the amalgamation of the Vaccination with the Sanitary Department had been carried out in all the provinces of India excepting the Punjab. In October of 1881 that province also was brought under the arrangement, the amalgamation of the two departments throughout the whole of British India is thus completed. Every endeavour is now being made to make these new establishments as useful as possible in sanitary work. With this view, vaccinators were being instructed in the elements of sanitary science, a knowledge of which would enable them to assist greatly in the diffusion of sanitary information among the people, especially the villagers. The system of local self-government which has lately been inaugurated, and which is being generally introduced into all the provinces of India, will, it is anticipated, also have a decided influence on sanitary progress.

Bengal.

On the whole, satisfactory progress was made in improving the sanitary condition of the town of Calcutta during 1881. Much attention was given by the Commissioners to road-making, bustee improvements, and filling in of noxious tanks, and, notwithstanding the difficulties with which these matters are beset, progress was apparent in almost every direction. But the most urgent of all the needs of the town is the extension of the water-supply. During the year the supply was again found to be very insufficient, while the demand continued to increase, as is shown by the fact that 537 new connexions were made in the course of the year, making a total of 13,386 premises now connected. The matter was receiving the attention of the Commissioners, and various measures were in course of adoption. The deficiency, however, would to some extent be met when the arrangements for increasing the unfiltered supply were completed, which it was hoped would be some time in 1883, as by these means all the filtered water used for watering the streets, &c., would be set free. It is estimated that a million or more gallons a day of filtered water will then be added to the present consumption to meet the growing wants of the town. The drainage system of Calcutta was fast approaching completion, and the Municipal Committee hoped that by the end of 1883 the work would be brought to a conclusion. In the course of 1881, 14·15 miles of drainage were finished, leaving only 21·12 miles to complete the work. "Four or five years more of such "improvements as have been carried out in 1881," it is stated in the Commissioners' Report, "will make a very perceptible difference in the northern part of the town; at the "same time, unless these measures are supplemented by others, the Commissioners "are well aware that they will be abortive."

With the view of further improving the sanitary condition of the port of Calcutta, measures have been adopted to prevent the defilement by coolies of that part of the Calcutta foreshore extending from Matiabruj Ghât down to the upper boundary of the Bengal Cotton Mills premises. Owners of lands on the river-side have been warned to prevent the commission of nuisances on their lands, and notices have been issued to owners of premises where kerosine oil, cargoes, or straw was discharged, to provide common latrines for persons resorting to their premises; in the meantime temporary latrines have been provided and arrangements made for cleaning them, and the Commissioner of Police has been requested to station constables to prevent the committal of nuisances. A large latrine has been constructed on the edge of the river bank by the East Indian Railway Company, but no extension of latrine accommodation had been made by the Port Commissioners or the Calcutta Corporation.

The proportion of municipal income expended on sanitary works in Bengal during the year was 24 per cent. of a total income of 279,121*l.* against 27 per cent. of income in 1880. Generally speaking, fair progress was made in sanitation in the towns and districts, particularly with regard to drainage, the cleansings of the abominable private privies by the municipal mehters instead of private mehters, and the construction, metalling, and improvement of roads. Among the principal works that were finished or in progress were the following.

In the suburbs of Calcutta great improvements in bustees have been carried out, and a scheme for the supply of water has been approved. The Government had offered a grant of Rs. 1,70,000 to the suburban municipality for the carrying out of the work, providing it was commenced in January of 1883. "Till the great aggregations of people

" round Calcutta are placed in good sanitary condition," the Sanitary Commissioner says, " it can never be hoped that very material improvement will take place in general health."

The Eden or Jujuti Canal project, by which a supply of good water was made available for the districts of Burdwan and Hooghly, and the country through which the canal passes, was completed in December. The Burdwan water-supply scheme, for supplying the town with filtered water from the Damuda through distributary pipes, was matured, and a loan, repayable by levying a water-rate on the holdings that will be benefited by the measure, was to be applied for. It was in contemplation also to re-open the old Gangoor river in the Burdwan district, by which a large tract of country will be drained and supplied with good water.

In Manbhum the Govindpore lake has been made by private subscription, and will be the means of providing sufficient good water to a large number of people residing in its locality, and to travellers passing along the Grand Trunk Road.

At Dinagepore the main drainage channel with its subsidiary drains was completed, the entire cost amounting to 5,734*l*. At Rungpore also the drainage of the town was further improved by constructing surface drains and joining them to the main drainage.

In Dacca many sanitary improvements were effected. New drains were constructed, and a complete drainage scheme was under consideration. It had also been determined to extend the waterworks to the whole town, and under the orders of the Lieutenant-Governor it was decided to improve the sanitary condition of, and to convert into a civil station, the important but very filthy commercial town of Naraingunge.

Appreciable improvements were carried out in the town of Darjeeling and several other districts, while district officers and others in many cases had been especially instrumental in promoting sanitation. In a number of towns, including, as the Army Sanitary Commission point out, the great pilgrim cholera centre, Poori, the Bengal Municipal Act was extended, and the Act empowering the Commissioners of first-class municipalities to control public and private latrines was also brought into operation in several places for the first time.

In connexion with the scheme of local self-government the Lieutenant-Governor had directed that the municipalities, stations, and unions in Bengal should be relieved of all police charges from the financial year 1882–83. "The effect of these orders," the Sanitary Commissioner says, "will therefore be to give them a grant of three and a half " lacs of rupees per annum; and the intention of this concession is, that this amount shall " be expended on sanitation, and on other works of improvement, and on education— " the last subject has been, however, postponed for future consideration. The great draw- " back to progress in sanitation, viz. want of funds, has thus to a material extent been " removed, and it is hoped that the municipalities will now be enabled to carry out some " of the many sanitary and other improvements which are urgently called for in many " towns."

Madras. Considerable attention appears to have been given to sanitary work in the Madras municipality during 1881. In the work of diverting sewage from the river Cooum, wherever it was possible land was taken near the outfalls, and the sewage from the various sewers led into wells on the land obtained. In the course of the year the sewage from eight separate sewers which flowed into the river was diverted in this way, and the sewage was being profitably disposed of over the lands from which large crops of grass are obtained. "In another year or two," the President observes, "it is to be hoped " that the Cooum will be freed from all sewage except what is brought in during heavy " rains, and its general condition greatly purified."

Mr. Jones's scheme for the drainage of Black Town has been accepted by the Madras Government, and sanction was given for the raising of a loan of 10,000*l*. in order to commence operations. Towards the extension of water-supply the Commissioners determined to complete as far as possible the distribution of the Red Hills water throughout so much of the area of the city as was intended to be supplied, and for this purpose they had sanctioned the raising of a loan of 25,000*l*., a sum which it was estimated would complete the work, and which had also received the sanction of Government.

Conservancy arrangements were well attended to, and in many places great improvements effected. In the Tinnevelly Settlement and Nagatha Covil Parcherry, which were formerly the most loathsome and filthy quarters of the town, huts were removed, and lanes and streets thoroughly opened to sanitation, a step which had greatly conduced to the health of the people during the recent cholera epidemic. Owing to the outbreak of cholera the conservancy staff had also been considerably strengthened, and overseers of wards had been specially instructed to give redoubled energy in sanitation and conservancy, especially to inspection, and much good had already resulted.

Although no work of any great magnitude was undertaken in the Madras Presidency during 1881, sanitary work generally appears to have been fairly well prosecuted. Conservancy arrangements were considered on the whole satisfactory, but in matters of water-supply and house sanitation there was still much need for improvement. "Progress "in this direction, however," the Governor remarks, "depends so much upon a change "in many of the native habits and ideas, that much advance is to be looked for only as "an intelligent apprehension of the importance of these things spreads among the "people." Out of a total municipal income of 147,323*l.*, 31 per cent. was allotted for sanitary purposes, but of this amount a little over one-fourth remained unutilised, and only in three instances was the full allotment expended. In future, Presidents were to be held responsible that the budgeted grants were not allowed to lapse without the express sanction of Government.

In local fund circles the total available income (one-third land cess) was 135,140*l.* Of this sum 38,696*l.* were alloted for sanitary purposes, of which, however, less than two-thirds were so expended. There would seem to be a great want of conservancy arrangements in the towns and villages of some circles. "Many towns and villages," the Sanitary Commissioner states, "are left to take care of themselves at the mercy of the "rural population. These people cannot be made to understand what filth and "dirt mean, and are so ignorant of the rudiments of sanitation, that they violate its very "law every day of their lives, by polluting the water-supply in every possible manner, "defiling village sites, waste lands, corners of bye-lanes and streets, and tank-banks with "human excrement, and by accumulating heaps of manure, and other offensive and "noxious matters injurious to public health in and around their dwellings." To remedy this state of things, he strongly urges that legal power should be given to district authorities to enforce the observance of simple rules of sanitation, that more professional supervision should be introduced, and that villages should be more frequently inspected by some responsible officers, who should be empowered to deal with not only external but internal dirt also. In regard to improvements in villages, the Army Sanitary Commission again recommend that existing methods of dealing with them, "such as they are, should "be better systematised, and the village officials called on to give practical effect to "powers which they appear to have already. And we hope," they say, "with the "Government of Madras, that 'in local fund circles the Government trust that the "'several boards will soon see their way to making larger sanitary grants than they do "'at present, especially for the improvement of village sites and of the water-supply. "'As it is, the allotments, the Government regret to notice, were not fully utilised. In "'no circle can it with truth be pretended that objects were wanting on which the "'money might be usefully expended. The Board of Revenue are requested to pay "'special attention to this matter.'"

Sanitary arrangements at Madras festivals.

The results of the fairs and festivals held in the Madras Presidency between September 1881 and December 1882 show that with very few exceptions the sanitary and other arrangements were satisfactory, and that the great majority were exempt from cholera. The Army Sanitary Commission notice that the practical lesson to be learnt from these festivals is that camping outside and away from the crowded town populations should be the rule, and that considerable increase of the conservancy staff and arrangements are required.

Bombay.

The new main sewer of Bombay city, extending from Frere Road, near Carnac Bunder, to Love Grove, near the new pumping station, a distance of 4¼ miles, was completed by the 1st June 1881. The outfall sewer was also completed, but owing to unusually severe weather the rubble and concrete covering of the sea end for a length of 192 feet was displaced, but before the close of the year the greater part was repaired. The foundations of the new pumping station at Love Grove were finished during the year, and it was anticipated that the new engines would shortly be at work. Unfortunately, slow progress was made with pipe sewer work in connexion with the main sewer, which caused great inconvenience to the public. At the end of the year 16¼ miles of pipe out of 23¾ miles had been laid.

Several important surveys in connexion with the main and outfall sewers were under consideration, the chief of which were—

1. The survey and estimates for house connexion in the first portion of the sewage scheme.
2. The connexion of the new sewerage system to the district of Kamathipura, with house connexions complete.
3. The interception of the present outfalls in Back Bay.

4. A new and comprehensive surface drainage scheme, comprising several new drains and a flood reservoir on the flats.

As regards water-supply, the most important work carried out was the raising of the dams of the Tulsi Lake by 6 feet. It was estimated that this would yield an additional storage of 480 million gallons. In consequence, however, of the comparatively small rainfall, the lake did not fill up its waste weir level, and the addition to the storage was consequently only 234 million gallons. But slight progress was made with the Bhandawara reservoir, a little more than one-half of the work which it was expected would have been completed remaining unfinished. To a certain extent the work has been attended with unexpected difficulties, "but with every allowance for these," the Municipal Commissioner observes, "the slow progress made by the contractors cannot "be justified, and as it is of the greatest importance that the reservoir should be avail-"able for use as soon as possible; it will now be a question whether the contract must "not be taken out of their hands."

Conservancy work received considerable attention. Progress was made in the reclamation of flats, in the improvement, construction, and regulation of cattle-sheds, and in regulation of unwholesome trades, and prevention of nuisances. The year's experience shows, as the Army Sanitary Commission remark, that real progress is being made in rooting out the epidemic disease causes in the city, but the Commission consider that more progress ought to have been made with the drainage, considering the time that has elapsed since the question was first discussed, and that the water-supply must be increased.

In the Bombay Presidency the total income of the municipalities, exclusive of Bombay city, was 256,979*l.*, of which 63,371*l.* were expended on conservancy arrangements. In several towns important improvements were carried out in waterworks; and much attention was devoted to the cleansing and repairing of drains, to the erection and repairing of latrines, besides other minor sanitary matters. Of late years good progress has been made in improving the sanitary condition of the towns of Bombay; but, as pointed out by the Army Sanitary Commission, the death statistics of some show that increased activity in this direction is much needed.

Sanitary work in the local fund circles consisted chiefly in the improvement of wells and other water sources.

Punjab.

The only important sanitary work executed in the Punjab in 1881 was the completion of the works for the water-supply of Lahore. The service reservoir had failed, but a constant supply had been kept up to the whole of the city and suburbs, with the exception of certain localities at a high elevation. The water was pronounced to be of excellent quality, and the prejudice which the people had at first entertained regarding it was disappearing, and the demand gradually increasing. The householders, it is stated, were not showing much disposition to have the water connected with their houses, which is attributed to the water-rates being too high; consequently the *bhisties* employed by the richer inhabitants take possession of the stand-posts to the exclusion of the poorer classes. The drainage works of the city were reported to be progressing satisfactorily, and when completed would leave little to be desired in respect of thorough conservancy.

At Delhi plans and estimates for the city waterworks were completed; the old Shahjahani drains were opened up and thoroughly cleaned out; and the Conservancy Department, which was re-organised in 1879, has proved very successful, with the result that the city is now pronounced by all to be very clean and healthy.

At Peshawar a considerable sum was expended on the construction in the city of masonry channels for sewage and for drinking water. These, the Lieutenant-Governor remarks, no doubt constitute a great improvement on the state of things previously existing, but it cannot be allowed that they ensure the water-supply from dangerous pollution. In discussing the disadvantages of the scheme, the Army Sanitary Commission recommend that no similar scheme should be sanctioned for any town in future.

At Amritsar the main drainage scheme was nearly completed round the eastern side of the city, and the internal drainage had been improved by the adjustment of the street drains with the outer main drain. The subject of the drainage of the whole locality with a view of obviating the swamping and water-logging of the soil which resulted from the heavy rainfall of the year has been taken up and surveys have been made. A scheme for improving the water-supply was also under consideration.

In Jullundur and Hoshiarpur important drainage schemes were being carried out; in Ludhiana special measures have been taken to preserve the water-supply both of the district and town from pollution; and in Rawalpindi a scheme for supplying the town with pure water was about to be proceeded with.

Sanitary improvement was engaging the earnest attention of the district authorities, and a fair share of the funds at their disposal was devoted to it. In nearly all the central towns, however, a supply of pure water brought from beyond the inhabited area was much wanted, and in many improved drainage was urgently needed. During the year a considerable number of villages were inspected, when grave sanitary evils were brought to light. These insanitary conditions, the Lieutenant-Governor observes, are closely connected with the habits of the people, and no general reform in these habits can be looked for until the people are convinced of the evils resulting from them. Efforts were, however, being made to diffuse better knowledge on these points among the natives, and Dr. Cuningham's Sanitary Primer has been widely distributed, and has been introduced as a text-book in a large number of schools.

North-Western Provinces and Oudh.

No sanitary work on any great scale was carried out in the North-Western Provinces and Oudh during 1881, still much good work was done in the municipalities in surface drainage, providing sources of pure water, filling in excavations, cleansing wells, &c.

At Almora the drainage of the town site was completed, and the town has now a plentiful supply of good water. The public latrine arrangements were also extended. At Bulandshahr a work of considerable sanitary importance for preventing flooding was carried out, and much progress made in general town improvements. At Cawnpore City a total length of 13,509 running feet of the new drainage system was constructed, and two unwholesome excavations in the middle of the city were completely filled up and levelled, a work which the Sanitary Commissioner considers a very important sanitary improvement. The main city drainage way was extended for the further effectual removal of the rainfall drainage. At Benares the keeping of pigs within the municipal limits was forbidden, but no progress was made with the long-proposed water-supply and drainage scheme, it remaining still under the earnest consideration of the Municipal Committee. At Lucknow a total length of 30,838 feet of stone and masonry-built drains was constructed, new wells were sunk, 17 ditches had been filled up, and many others were in process of filling, and an artesian well sanctioned.

Considerable progress is also said to have been made in rural sanitation, and several districts—notably Jalaun and Bahraich—are stated to have followed the example set by Mr. McConaghey in Banda of enforcing a few simple rules to secure cleanliness, and to prevent the pollution of the water-supply. No opposition of any moment to any of the rules appears to have been offered, while the improvement which has been effected in the health of the people by their introduction was very satisfactory.

Central Provinces.

In the Central Provinces the chief sanitary event of the year was the commencement of a scheme for supplying the city and station of Jubbulpore with pure water from a reservoir seven miles distant, at an estimated cost of 60,000*l*. The work was being actively carried on, and hopes were entertained that early in 1883 the first supply would be turned into the city. Good progress was being made with the Hinganghat water-works, and in several other towns improvements were effected in their sources of water-supply. Out of a total income of 52,214*l*., the municipalities spent 12,338*l*. on conservancy arrangements.

Much good work was done by Civil Surgeons of districts in their inspections of towns and villages; but their reports testify to the fact that many villages suffered from epidemics through their bad sanitary condition. "Vaccination officers," the Sanitary Commissioner reports, "appear to have done fair work in advising the people of the "villages on matters of sanitation, and in every district except Seoni have reported "some villages as clean, and as attempting sanitary improvements; of course it cannot "be expected that great progress can be made in one, two, or even perhaps in ten "years, but there is every reason to believe that some good has been already effected, "and that the vaccination staff, if properly supervised and kept to their work, will prove "a most valuable aid in this direction, and that ultimately substantial progress will be "made in village sanitation."

Berar.

No sanitary works of any great importance were undertaken during the year in the municipalities of Berar, but conservancy and general sanitary arrangements received attention. In the five municipalities of the province the total sanitary expenditure amounted to 2,586*l*. A scheme for the supply of water to the town of Khamgaon was sanctioned, the estimated cost being 8,636*l*. The work, it is stated, was soon to be commenced, and when complete the waterworks are expected to provide an adequate supply of water for all purposes. A project for supplying the town of Amraoti with water was under consideration, but the drainage scheme still remained to be completed.

In the districts a large amount of useful work was effected in the course of the year at an expenditure of 8,903*l.*, especially in villages containing more than 5,000 inhabitants, which for registration purposes are classed as towns. The employment of Native Superintendents of Vaccination in sanitary inspection work was attended with satisfactory results, their inspection having proved specially conducive to more careful registration of vital statistics. With the view of extending village sanitation, every village patel has been furnished with a copy of the village sanitary rules, and Dr. Cuningham's "Sanitary Primer" has been distributed throughout the vaccination service, and also circulated to all schools in the province.

Assam. Very little progress appears to have been made during 1881 in the way of sanitary improvements in Assam. In fact, as the Army Sanitary Commission remark, sanitary work in this province "is only being begun." The chief improvement effected was the extension of the water-supply to the village of Maokhar and to the regimental lines in the cantonment of Shillong. The drainage system of Gauhati was being slowly carried on, and it is satisfactory to learn that the introduction of properly sunk wells fitted with apparatus for lifting the water was beginning to claim the attention of municipalities. "Even to recognise the necessity of a wholesome water-supply," the Sanitary Commissioner observes, "is a step forward, a mark of progression, and one hails it as a ray of "light in a dark and dismal passage." The Government of India have now called the attention of the Chief Commissioner to the want of a pure water-supply in the towns of Assam, expressing a hope "that funds will be speedily made available for this very "necessary reform."

During his tour of inspection the Sanitary Commissioner visited many tea-gardens, and he again testifies to the care and attention bestowed on the tea coolies. "The general hutting of the coolies," he says, "and the water-supply in many of the tea-gardens, "showed marked signs of improvement, and in many of the better class of gardens I "met with indisputable evidence of the kindly treatment bestowed by managers them-"selves on the tea-garden labourer."

British Burma. Except in the larger towns, little progress was made in improving sanitation in British Burma. Great progress was made during 1881 in the construction of the works for supplying the town and shipping of Rangoon with water, and for improving the surface drainage of the town upwards of 5,000*l.* have been sanctioned. At Prome sanitary works were energetically carried on; a complete drainage scheme was sanctioned, the works being already in progress; plans were in course of preparation for the erection of a bund to prevent the annual flooding of the town; a scheme for the water-supply of the town was also under consideration, and efforts were being made to abolish the cesspit system. At Bassein 7,000 feet of brick drains were constructed in the course of the year; the reclamation of a great part of the Athegyee swamp was completed; additional public latrines were erected; cesspits were being replaced by proper drains, and a scheme for supplying the town with water was under consideration. At several other towns important improvements were being carried out. In the villages efforts were being made to extend a knowledge of elementary sanitary principles among the people. "A trans-"lation of Dr. Cuningham's Sanitary Primer," the Government state, "altered so as to "specially adapt it to Burma, has been prescribed as a school text-book, and copies of "the work are being distributed as widely as possible throughout the province; mean-"while district officers should lose no opportunity of encouraging and assisting the people "in improving the sanitary condition of villages."

Military.

Bengal. In the extension of military works in the Bengal Presidency, a sum of 626,243*l.* was expended during the year 1881-82, a large proportion being devoted to sanitary works conducing to the well-being of the soldier. At several stations extensive additions were in progress for the accommodation of both European and Native troops, and many important works for the general improvement of cantonments were in hand. At Allahabad measures were taken for the better supply of water to the cantonment, and the question of providing an improved water-supply both for cantonments and for the fort was under consideration. At Lucknow the drainage of cantonments had been sanctioned at an estimated cost of 1,654*l.*; the earthwork of drains in the Royal Artillery lines was completed, and a large masonry fall near the same lines commenced. When finished, this latter work is expected to prove very beneficial. At Naini Tal progress was made with the drainage, water-supply, and protective works, and two-thirds

of the undertaking, involving an outlay of 4,000*l.*, were executed. At Amballa satisfactory advance was made with the important water-supply project, 8,459*l.* having been expended on it during the year, and progress was made with the distribution works. The British and Native Infantry bazar reservoirs in connexion with this work were executed, and the actual yield of water was about 210,000 gallons a day. Another important work in water-supply was also in progress at Peshawar. The filter-beds and service reservoirs were completed at a cost of 9,862*l.*; a commencement had been made with the distribution, and at the close of the year was accomplished through about half the length of the station. At Cherat good progress was made with the water-supply, and storage room provided for 21,874 gallons, the daily average supply from the springs being about 13,000 gallons. At Quetta the drainage scheme was commenced, some of the channels being newly aligned, widened, and properly sloped.

Madras.

In the Madras Presidency various improvements were effected in connexion with the barracks of European troops, and at the several stations the usual amount of conservancy and other minor sanitary work was carried out. Among the more important sanitary works in progress or undertaken during the year was a system of drainage at Secunderabad, which was being constructed to carry off the foul water from the Royal Artillery married quarters, an improvement which appears to have been greatly needed. From all stations favourable reports were received as to the quality and quantity of the water-supply, while every care was taken to prevent pollution, and filters were in use. No pains were spared, it is stated, to amuse the men and to make time pass as pleasantly as possible, special recreation and reading-rooms having been provided, out-of-door games and gymnastics encouraged, and soldiers' gardens and other means of recreation fostered.

Bombay.

The actual outlay on military sanitary works in the Bombay Presidency during 1881 was 42,211*l.*, of which amount 24,310*l.* were expended on the new water-supply of Nasirabad. The drainage of the bazar at Nasirabad was also being further improved at the expense of the Cantonment Fund. At Poona the drainage of the Ghorpuri lines was improved, as was also the ventilation of the barracks by wire-gauze doors to break the inflowing currents on the men at night. At Hyderabad steps were being taken to modify the overflow from the Indus river in the vicinity of the cantonment, and a scheme for improving the drainage of the military buildings was approved. The insanitary condition of the station of Neemuch was still engaging the attention of the authorities, and medical officers were requested to submit reports as to the probable causes of sickness peculiar to the station. At several other stations improvements in surface drainage were carried out, extra accommodation was being provided, and attention given to minor sanitary matters. Healthful exercise was promoted as much as possible; the men are encouraged in various ways to occupy themselves with handicrafts and gardening; and at most of the stations recreation and reading-rooms are provided.

India Office, August 1883.

ABSTRACTS

OF

SANITARY AND OTHER REPORTS

FOR

1881.

ABSTRACT OF REPORT OF THE SANITARY COMMISSIONER WITH THE GOVERNMENT OF INDIA FOR 1881.

(Dr. J. M. Cuningham.)

European Troops.

Sickness & mortality among European troops.

During the years 1879 and 1880, the sanitary history of troops in India was complicated by the fact that a large proportion of them was on field service in Afghanistan. Special tables were needed to separate the statistics of the troops in the field from those of the troops in cantonments, so that the results regarding the army as a whole during the year under review might be properly compared with the results of previous years. For 1881, however, such separate tables are not called for, as nearly all the troops on active service had returned to cantonments by October of the preceding year. Nevertheless, a considerable number of European troops were stationed in Southern Afghanistan during 1881, a strength varying from 3,939 during April to 860 during December. Although these cannot be said to have been on field service, still in many respects—such, for example, as barracks and general surroundings—they were differently circumstanced from what they would have been in Indian cantonments. A special table has therefore been prepared giving the sanitary history of this particular section of the European army, and separate columns have been introduced into other tabular statements with the object of keeping these statistics distinct from those of the army generally.

The average strength of the European army in India was 58,728 during the year, or about a thousand lower than it was in 1880. The sanitary history of the year, as judged from the sick and death-rates, was very favourable. The mortality, 16·86 per 1,000, was 8 per 1,000 lower than the death-rate amongst troops in cantonments during 1880, and lower than in any year since 1877, when it was only 12·71. The admissions into hospital also, 1,604 per 1,000, were lower during 1881 than they had been since 1877; and the daily sick-rate, 69, was lower than it had been during the preceding two years. The principal statistics of each of these five years will be found in the subjoined statement.

Year.	Average Strength.	Ratio per 1,000 of Average Strength.				
		Admissions into Hospital.	Daily sick.	Deaths.	Invaliding.	Total loss.
1877 - - - -	57,260	1,257	56	12·71	42	55
1878 - - - -	56,475	1,651	67	21·46	45	66
1879* - - - -	49,582	1,977	78	24·29	49†	73†
1880* - - - -	51,795	1,789	74	24·85	26	51†
1881† - - - -	58,728	1,604	69	16·86	38	55

* Excluding troops serving in Afghanistan. † Including troops in Afghanistan.

The "Vital statistics of the European army of India for the Ten-year period, 1870–79," afford an easy means of comparing the results of the year under report, and those of the preceding ten years either individually or taken as a whole. This work, was commenced by the late Surgeon-Major Bryden in continuation of the previous ten-year period, 1860–69, and has been completed by Surgeon-Major Stephen. The admission and daily sick-rates were above those of the preceding ten-year period, but the death-rate was 2½ (nearly) per 1,000 lower. The invaliding during 1881 was also low as compared with recent years, and was 5 per 1,000 lower than the average of this ten-year period.

Statistics of the European Army of India for the ten-year period, 1870–79, and for 1880 and 1881, compared.

Period.	Strength.	Per 1,000 of Strength.				
		Admissions.	Daily sick.	Deaths.	Invaliding.	Total loss.
1870–78	577,416	1,475	60	19·34	43	62
1880*	51,796	1,789	74	24·85	26†	51†
1881†	58,728	1,604	79	16·86	38	55

* Excluding troops in Afghanistan. † Including troops in Afghanistan.

Nearly two-thirds of the European troops in India are stationed in Bengal, so that the health statistics of the army, as a whole, are greatly dependent on the results obtained in this Presidency. As compared with 1880, there was an improvement during 1881 in the average daily sick, the admissions and the death-rates. The proportion of daily sick was 72 against 75, the admission-rate 1,729 against 1,813, and the mortality 17·05 against 27·73. Not only are the mortality statistics of 1881 favourable, as compared with 1880, but also as compared with the two preceding decennial periods. In the decennium 1860–69, the average death-rate was 29·98, or nearly 30 per 1,000. In the next ten-year period, 1870–79, it was 21·00, or 9 per 1,000 lower. During the year under review, therefore, the mortality amongst the troops in the Bengal Presidency was 4 per 1,000 lower than it was during the period 1870–79, and nearly 13 per 1,000 lower than during the period 1860–69.

Statistics of the Army of Bengal for the ten-year periods, 1860–69, 1870–79, and for 1880 and 1881, compared.

Period.	Average Annual Ratio per 1,000.				
	Admissions.	Daily Sick.	Deaths.	Invaliding.	Total Loss.
1860–69	1,755	67	29·98	41	71
1870–79	1,522	61	21·00	41	62
1880*	1,813	75	27·73	22†	50†
1881*	1,729	72	17·05	37†	54†

* Excluding troops in Afghanistan. † Including troops in Afghanistan.

In this report for 1880, it was remarked that the statistics of the European troops serving in the Madras Presidency were exceptionally favourable. On the whole, they were equally favourable during 1881; for, though the mortality rose from the very low ratio of 10·18 in 1880 to 10·97, the admission-rate fell from 1,368 to 1,160, and the daily sick-rate from 64 to 60. The invaliding, 28 per 1,000 (excluding troops in Afghanistan), was higher by eight during 1881 than it was in the previous year; but it was nevertheless considerably lower than in other years, and, as will be seen from the figures given in the following paragraph, very much lower than the average of the decennium 1870–79, which was 49 per 1,000 of the strength.

The death-rate amongst European troops of the Madras Army was lower during 1880 and 1881 than it has been in any year since the statistics of the Presidency have been compiled in this Office; in both years the ratio was more than six per 1,000 below the average of the ten preceding years. The admission-rate for 1881 was also somewhat lower than the averages of this ten-year period; and, as compared with the average of the ten years 1860–69, the results under all headings were still more favourable, as will be seen from the accompanying statement:—

Statistics of the Army of Madras for the ten-year periods 1860–69 and 1870–79, and for 1880 and 1881, compared.

Period.	Average Annual Ratio per 1,000.				
	Admissions into Hospital.	Daily Sick.	Deaths.	Invaliding.	Total Loss.
1860–69*	1,399	61	19·99	49	69
1870–79	1,264	60	17·69	49	67
1880	1,368	64	10·18	20	30
1881	1,160	60	10·97	28	39

* The figures from which these Ratios were calculated are given in this Office Annual Report for 1877, page 42.

In summarising the statistics of the European troops in Bombay during 1880, it was observed that the death-rate of the year, 30·90 per 1,000, was almost double what it had been in 1879, and that, too, although in 1880 not a single case of cholera had occurred amongst the troops in cantonments. The results for 1881 are even more favourable than those for 1879, the mortality having been only 13·44. The admission-rate for 1881 was 1,784, against 2,150 in 1880, and the daily sick-rate 72 against 78. The invaliding, however, was somewhat higher during 1881—53 against 49 per 1,000.

Statistics are not available to show the averages in the Bombay Presidency for the ten years 1860–69; but in this Office Annual Report for 1875, figures are given for these ten years, divided into two periods of five years each. For comparision with the results of the last two years these are reproduced in the annexed statement, which also shows the ratios for the ten years 1870–79.

Statistics of the Army of Bombay for 1860–64, 1865–69, and 1870–79, compared with 1880 and 1881.

Period.	Average Ratio per 1,000.				
	Admissions into Hospital.	Daily Sick.	Deaths.	Invaliding.	Total Loss.
1860–64 - - - -	1,724	†	22·61	30	53
1865–69 - - - -	1,406	56	20·48	36	56
1870–79 - - - -	1,533	57	15·27	43	58
1880 - - - -	2,150	78	30·90	49	80
1881 - - - -	1,784	72	13·44	53†	67†

* Excluding troops in Afghanistan. † Including troops in Afghanistan.

It will be seen from the above that the admission, daily sick, and death-rates of the year under report compare very favourably with those of 1880. As regards the mortality, it also compares favourably with the ten and the two five-year periods into which the statistics of the preceding twenty years are classified. The sickness, however, was higher during the last two years, and the invaliding during 1881 was above the averages of the five and ten year periods.

As already mentioned a portion of the European army of India during 1881 was in Southern Afghanistan. These troops were taken partly from Bengal and partly from Bombay. The average strength of the whole was 2,541. Though the admission-rate was low, 968 per 1,000, the daily sick and death-rates equalled 72 and 51·55 respectively. These troops suffered severely from enteric fever, dysentery, and respiratory diseases.

The relative prevalence of the several forms of sickness was in accord with the experience of previous years. Malarial fever stood first in each of the three Presidencies, but whereas in Bengal and Bombay about half the total admission-rate was due to this cause, in Madras it gave rise to little more than one-fourth. This will be seen from a glance at the following statement, where the principal causes of admission into hospital are arranged in the order of frequency, together with the ratios per 1,000 of strength from each cause. With one trifling exception, the admissions bore the same relative frequency in each of the three Presidencies :—

Admissions from Chief Diseases per 1,000 *of strength.*

Bengal.		Madras.		Bombay.	
1. Malarial fevers -	764	1. Malarial fevers -	279	1. Malarial fevers -	841
2. Venereal diseases -	276	2. Venereal diseases -	258	2. Venereal diseases -	261
3. Wounds and accidents -	106	3. Wounds and accidents	104	3. Wounds and accidents	106
4. Respiratory diseases -	87	4. Abscess and ulcer -	78	4. Respiratory diseases	93
5. Abscess and ulcer -	86	5. Respiratory diseases	60	5. Abscess and ulcer -	86
6. Diarrhœa - -	56	6. Diarrhœa - -	44	6. Diarrhœa - -	57
7. Rheumatism - -	50	7. Rheumatism -	43	7. Rheumatism -	40
8. Hepatitis - -	32	8. Hepatitis - -	39	8. Hepatitis - -	29
9. Dysentery - -	29	9. Dysentery - -	37	9. Dysentery - -	23
Total of the nine -	1,486		931		1,536
Total from all causes -	1,729		1,160		1,784

With regard to the diseases which gave rise to the greatest mortality, cholera stood highest in Bengal and in Madras; the ratios having been 3·23 and 1·73 per 1,000 for these Presidencies respectively, and next to it enteric fever in Bengal and Bombay. In the latter Presidency cholera occupied the lowest position amongst the chief causes of death. The subjoined statement gives, in a concise form, the chief causes of mortality, and also the death-rate from all causes in the three Presidencies for a series of years :—

Deaths from	Bengal.				Madras.			Bombay.		
	1881.*	1880.*	1870-79.	1860-69.	1881.	1880.	1870-79.	1881.*	1880.	1870-79.
Cholera	3·23	4·84	4·18	9·24	1·73	0·10	1·68	0·30	—	1·53
Enteric Fever	2·62	3·07	2·28	?	0·58	1·36	1·42	2·83	5·76	1·75
Apoplexy	1·75	3·14	1·53	2·19	0·96	0·78	1·42	1·21	3·03	1·56
Hepatitis	1·64	1·86	2·04	3·31	1·54	1·26	3·16	1·52	1·31	1·71
Dysentery	1·00	2·72	1·37	2·72	1·15	0·58	2·32	1·82	4·14	0·98
Diarrhœa	0·31	1·17	0·12	0·75	0·19	0·19	0·04	0·30	2·02	0·17
Remittent and Continued Fevers	0·70	2·34	1·74†	2·92	0·19	0·29	0·62†	0·91	2·73	1·14†
Total of these diseases	11·25	18·64	13·26	21·13	6·34	4·56	10·66	8·88	18·99	8·84
All causes	17·05	27·73	21·00	29·98	10·97	10·18	17·69	13·44	30·90	15·27

* Excluding troops in Afghanistan and on the march. † Include deaths from intermittent fever.

This statement further serves to show that in 1881 there was a general diminution in the mortality from enteric fever, as compared with the statistics of the year previous. In Bengal the death-rate from this cause fell from 3·07 to 2·62, in Madras from 1·36 to 0·58, and in Bombay from 5·76 to 2·83. During the ten-year period, 1860–69, the cases of enteric fever returned were so few that they were not classified separately, but included under remittent and continued fevers. The mortality amongst the troops in Madras is, under almost all the principal headings, lower than amongst those of the other two Presidencies.

Sickness and mortality in groups of stations.

The following statement shows the admission and death-rates in the several groups of stations of the Bengal Presidency during the ten-year periods, 1860–69, 1870–79, and during 1880 and 1881 :—

Period.	Ratio per 1,000 of strength.													
	Bengal Proper.		Gangetic Provinces and Oudh.		Meerut and Rohilcund.		Agra and Central India.		Punjab.		Hill Stations.		Bengal Presidency.	
	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.
1860-69	1,821	29·57	1,615	28·59	1,576	26·61	2,169	38·48	1,741	25·24	1,069	14·78	1,755	29·98
1870-79	1,811	14·48	1,410	20·06	1,461	18·31	1,530	18·41	1,847	20·71	1,044	12·23	1,522	21·00
1880*	1,469	16·03	1,494	29·82	2,011	22·98	1,935	15·07	2,126	36·41	1,253	20·75	1,813	27·73
1881*	1,610	12·02	1,741	15·94	1,867	17·81	1,728	10·11	1,949	23·44	1,177	9·97	1,729	17·05

* Excluding troops in Afghanistan.

The admission-rate varied in these groups of stations from 1,177 per 1,000 in the hills to 1,949 in the Punjab. From the above tabular statement it will be seen that the mortality, 23·44, was higher in the Punjab than in the other groups. This was also the case in 1880, when it was as high as 36·41. It was 45·01 in 1879. As compared with 1880, there is a diminution in the death-rate in all the groups, the decrease in the Gangetic provinces and Oudh group being very marked, from 29·32 per 1,000 to 15·94; but 14·50 of the total death-rate during 1880 was due to cholera. In 1881 the death-rate from cholera in this group was 2·97. As compared with the results of 1870–79, there was during 1881 a decrease in the mortality of each of the groups, with the exception of the Punjab, where the death-rate of these ten years averaged nearly 3 per 1,000 less than the death-rate of 1881. As compared with the ten-year period 1860–69, the decrease in the mortality of 1881 is still more marked. As averages alone may mislead, it should be added that between 1860 and 1869 the annual death-rate in the Bengal Presidency never fell below 20·11, and that in most of the years between 1870 and 1879, it largely exceeded the ratio for 1881. All these data show that a very considerable reduction has been effected in the mortality of European soldiers in the Bengal Presidency during the last 22 years.

The disease which gave rise to the highest death-rate in any of the groups was cholera, which caused a loss of 7·00 per 1,000 of strength in the Punjab; and the next highest death-rate was 4·90 per 1,000 from enteric fever, in the Agra and Central India group,—the group which furnished the lowest death-rate from cholera in the

Presidency, excepting the Hill stations, where the ratio was slightly lower. The death-rate from hepatitis, 2·30 per 1,000, was higher in the Gangetic provinces than in any other group.

There are 50 stations included in the several groups above referred to, 41 of which had an average strength of over 200 during 1881. Of these 41, two, Delhi and Amritsar, presented an admission-rate of over 3,000 per 1,000. Peshawar had an almost equally high admission-rate, namely, 2,966. In each of these three stations, fevers gave rise to over 2,000 of the total. Out of the 38 remaining stations, with a strength of 200 and over, four, Meerut, Jhansi, Fatehgarh, and Meean Meer, presented an admission-rate of over 2,000. About two-thirds of the total in them were due to fevers, with the exception of Meerut, where fevers contributed only 788, the total in this station being made up of high ratios under several other headings, diseases of respiratory organs, venereal diseases, and "all other causes."

As regards the mortality in the larger garrisons, four returned a death-rate of less than five per 1,000—Saugor, 2·69, Jhansi, 2·80, Fort William, 4·32, and Chakrata, 4·74. With the exception of Jhansi, the admission-rate in these four stations was also comparatively low; that for Fort William having been 1,566. For several years past, Fort William has been amongst the healthiest stations in the Bengal Presidency; during the last four years the death-rate here has ranged from 9·56 in 1878 to 4·32 in the year under review. From other stations the returns are much less favourable. Four of them show a death-rate of 40 per 1,000 and over—Jullunder 40·60, Amritsar and Govindgarh 46·61, Meean Meer 84·08, and the adjoining fortress of Lahore 137·93. The deplorable mortality at Meean Meer and Lahore was mainly due to cholera, 57·37 of the total death-rate having been due to this cause at Meean Meer, and 112·07 at Lahore. The mortality from other causes in these garrisons was therefore 27·71 and 25·86, respectively. At Jullundur, 6·02 of the total ratio was due to cholera, and 16·95 at Amritsar. Of the deaths from cholera which took place during 1881 in the Bengal Presidency, 80 occurred in the garrisons of the Punjab, and all, save one, occurred in the four stations above named.

During the ten-year period 1870—79, of the larger stations in the Bengal Presidency, eight have furnished an average annual death-rate of less than 12 per 1,000. Three of these are in the plains and five in the hills. The plains stations were Jhansi, with a ratio of 10·64, Fort William, with a ratio of 10·78, and Fategarh, with 11·51. In order to judge of the comparative healthiness of these stations, however, it is necessary to note also their average admission-rates during the same period; these were, at Jhansi 2,227 per 1,000, Fategarh 1,288, and at Fort William 1,106—so that, taken altogether, the returns, as regards sickness and mortality from the last-named garrison, have been the most favourable in the Presidency from 1870 to 1879. During the ten preceding years 1860—69, the average annual mortality at Fort William, 25·19, was more than double what it was during the period 1870—79. It is instructive to note the difference, during recent years, in the salubrity of this station, as compared with its near neighbours Dum-Dum and Barrackpore, which complete the Bengal Proper group. As already observed, all three are on the banks of the Hooghly, and the furthest removed is within 14 miles of Calcutta. The leading features in the sanitary history of these places during the ten-year periods 1860—69 and 1870—79, as also of the years 1880 and 1881 may be gathered from the following statement:—

Period.	Fort William.			Dum-Dum.			Barrackpore.		
	Admissions.	Deaths.		Admissions.	Deaths.		Admissions.	Deaths.	
		Cholera.	All causes.		Cholera.	All causes.		Cholera.	All causes.
1860–69	1,720	8·85	25·19	1,948	4·26	32·70	1,892	3·83	32·12
1870–79	1,106	1·26	10·78	1,188	0·50	15·33	2,011	0·49	20·96
1880	1,349	—	11·55	1,419	—	21·63	1,979	—	16·53
1881	1,566	1·08	4·32	1,582	4·29	17·17	1,829	—	24·39

During 1860 Fort William suffered very severely from cholera, 33·39 per 1,000, out of a total death-rate of 51·75, having been due to this disease. In 1862 there was another severe outbreak, causing a death-rate of 14·77 per 1,000, but since then the cholera mortality in any one year has never risen above 8·52 per 1,000. The reduction from 8·85 in the first ten-year period to 1·26 in the second is remarkable. In the other two stations, although cholera has also largely diminished, other diseases have not been reduced in a corresponding degree.

During the ten-year period 1860–69, there were 18 principal military stations, with a strength of more than 200 men, which returned an average annual death-rate of over 25 per 1,000. During the next ten-year period 1870–79, there were only two in this category—Peshawar, where the ratio was 28·55, and Meean Meer, where it was 34·87. Two other of the larger stations registered an annual mortality of nearly 25 per 1,000 during the same period, Morar and Fyzabad.

More than one-fourth, or 9,095, of the average strength of European troops in Bengal were located in the hills during 1881. Owing to the large proportion of troops on active service during the two preceding years, the number which could be placed on the hills was small as compared with ordinary years. Whereas in 1878, for example, 25·6 per cent. of the troops were on the hills, in 1879 the proportion was 13·7, and in 1880, 17·5. The percentage during 1881 was nearly equal to that of 1878, having been 25·3. There were further, 749 women and 1,511 children in the hills during the year under review. The admission-rate in the hill stations during the year equalled 1,177 per 1,000 against 1,253 in 1880; and the death-rate 9·97, against 20·75 for the same years. In 1880, 5·88 per 1,000 of the total mortality was due to enteric fever, against 2·49 in 1881. As regards the convalescent depôts the admission-rate was 1,394, against 1330 in 1880; and the death-rate 10·35, against 14·84. The chief causes of the decreased ratio during 1881 were a falling off in the deaths from phthisis, from 3·15 to 1·42 per 1,000, and a smaller proportion of deaths out of hospital.

As compared with the years 1879 and 1880, the returns of European troops of the Bombay Presidency serving in Rajputana, Malwa, Sind, and Aden in 1881 are very favourable. The admission-rate fell to 1,995 from 2,332 in 1880, and the death-rate from 23·94 to 11·90. Seven per 1,000 of the high death-rate of 1880 was due to enteric fever: in 1881 the mortality from this disease was 3·23.

The Deccan and Nagpur group of stations include the garrisons of Bombay, Poona and Kirkee, Belgaum, Secunderabad, Kamptee, and some smaller places. The strength of the group during 1881 was 7,426. The admission-rate was 1,390, against 1,708 during 1880; and the death-rate, 12·52, was almost identical with the ratio for 1880.

The Southern India group of stations consists of Bellary, Bangalore, Cannanore, Madras, and three other garrisons. The sanitary history of the group during 1881 corresponds very closely with that of the previous year—the admission-rate 1,236 against 1,411 in 1880; and the death-rate 7·74 against 7·23. With the exception of the hill stations of Madras and Bombay, the Southern India group furnished the most favourable mortality returns in the three Presidencies.

In last year's report it was mentioned that the troops serving in Burma and Pegu enjoyed better health than those of any of the other groups into which the army of India is divided. As already mentioned, the mortality in the Southern India group was, during 1881, the lowest; but, as regards admissions into hospital, the ratio for the Burma and Pegu group, 1,122 per 1,000, was the most favourable. The death-rate was 10·9 against 6·22 in 1880.

Amongst the troops occupying the hill stations and convalescent depôts of the Madras and Bombay Presidencies, of an average strength of 762, which was almost the same number as that of the preceding year, the admission-rate was 1,168 against 1,270 during 1880; the daily sick-rate 60 against 63, and the mortality 6·56 against 17·11. There was, thus, an improvement under every heading. There was only one death from enteric fever registered in this group.

The highest death-rate returned by any station in the Madras Presidency during 1881 was at Kamptee, 26·58 per 1,000; but more than one-half of this ratio was due to cholera, and 4·43 of the total deaths took place out of hospital. In 1880 the total mortality at this station equalled 20·73; but none of this was due to cholera or to deaths out of hospital. At Cannanore and Bangalore the death-rate during 1881 was but little over 5 per 1,000; and at Tounghoo, in British Burma, only 4·44. The statistics of the other stations for the year under review do not call for any special remarks. Of the larger cantonments, St. Thomas' Mount returned the highest death-rate during the ten-year period 1870–79, 21·70 per 1,000, with an average admission-rate of 1,264 and a daily sick-rate of 64. In 1880, although there was a marked diminution in the mortality, the ratio being only 14·33, the daily sick and admission-rates were high, 86 and 1,642. But in 1881 there was a falling off under each of the above heads; not only as compared with the figures of the year previous, but also as compared with the statistics of the ten-year period. During the above-cited decennium, the lowest death-rate, 9·52, was recorded at Bellary. At Wellington, during 1870—79 the death-rate

averaged 15·94 per 1,000; in 1800 the ratio stood at 12·92, and in 1881 it fell to 6·97.

The average death-rate amongst European troops in the cantonments of the Bombay Presidency during 1881 was 13·44 per 1,000. The statistics of individual stations show that, omitting small stations, this ratio was exceeded during the year by the death-rates for Nasirabad, Baroda, Karachi and Ghizree, and Ahmednagar. During 1880 the ratios at these places, with the exception of the last-named, were high. At Nasirabad, Karachi and Ghizree, the mortality ratios were likewise high during the ten-year period 1870—79, 21·69 and 16·11, nearly one-third in each instance having been contributed by enteric and other fevers. Taken altogether, the most favourable returns furnished by any station in the Bombay command were received from Aden; the admissions were 805, the daily sick 32, and the death-rate only 3·96 per 1,000. In 1880 the mortality at this station equalled 20·35, the high ratio having been, in great part, due to a considerable number of deaths from enteric fever. During the decennium ending 1879, the ratio stood at 14·15 per 1,000.

Cholera.

Of the 990 deaths which occurred amongst the European troops of the army of India, 137 were due to cholera, which is equal to a ratio of 2·33 per 1,000 of the strength. Thus, a little over one-seventh of the mortality from all causes was due to this disease. In 1880 the death-rate from cholera was a little higher than this, 2·8 per 1,000, and in 1879 the ratio went as high as 11·07; but considerably more than half of this mortality was due to deaths which occurred amongst the troops in Afghanistan. As regards the year under report, 116 of the total 137 deaths occurred in Bengal, 18 in Madras, and three in Bombay. No case occurred amongst the troops serving in Southern Afghanistan. Exactly one-half of all the deaths which occurred in the Bengal Presidency took place during June, July, and August, at Meean Meer. At the adjoining fortress of Lahore, 13 deaths occurred about the same period; and at Lucknow 17 deaths occurred, but, for the most part, later in the season. Compared with the ten-year period 1870—79, the cholera mortality for 1881 for the army of India was nearly 1 per 1,000 lower than the annual average, and the ratio for the army of Bengal was lower to somewhat the same extent; but as compared with the annual ratio yielded by the ten-year period 1860—69, the cholera mortality of 1881 in Bengal was very nearly one-third lower.

Small-pox.

Considering how widely prevalent small-pox is in most parts of India, it is remarkable how seldom European troops suffer from the disease. During 1881 there were only 17 cases, with one death, amongst the troops dispersed over the whole of India. And this is no unusual experience.

The low ratio of mortality from small-pox is manifest in each of the Presidencies. In Bengal the ratio for the ten-year period 1870—79, namely 0·12, is only about one-third of the annual ratio of the preceding ten years, 1860—69. Nor is the disease, as might have been expected, characterised by being specially limited to certain stations in different years. For example, the 60 deaths which occurred in the three Presidencies between 1870 and 1879 were distributed amongst 28 stations; and the 132 deaths which were registered in Bengal only, during the preceding ten-year period, occurred in 30 stations.

Fevers.

As usual, intermittent fever proved by far the most frequent cause of admissions into hospital; not only because of the prevalence of the disease in nearly every part of the country, but also because of its repeated recurrence in the same individual. In Bengal, the admission-rate, 663, was more than a third of the ratio from all causes; in Madras it was 238, or a little over a fifth of the total admissions. In Bombay the ratio was 754—not far from half the total admission-rate. Great fluctuation has occurred in the prevalence of this disease. In Bengal the admission-rate from intermittent fever was higher during the last two years than the annual average ratio of the two decennial periods, 1860–69 and 1870–79. In Madras and Bombay, there is a similar result as regards the two last years when compared with the ten-year period 1870–79. The mortality from intermittent fever is no guide to its prevalence. In the Bombay Presidency, for example, not a single death was ascribed to this cause during 1881; whereas, according to the admission-rate, it was more prevalent amongst the European troops of Bombay than among those of either of the other two Presidencies.

Fevers of a remittent and continued type, however, were not so prevalent as during the preceding year, nor were they as prevalent as during the immediately preceding ten-year period. Madras returned the lowest admission and death ratios from these

fevers, and the rates are lower than they were during 1880, or during the preceding decennium. In Bengal, also, there was a marked diminution during 1881, both in the admission-rate and still more in the death-rate, as compared with the year previous and likewise as compared with the average ratios of the two preceding ten-year periods.

It is not quite clear to what extent the diminished ratios from "continued fever" may not be due to greater separation of enteric fever from other types of fevers of a continued and more or less remittent character. Previous to 1871 no attempt was made to separate the statistics of enteric fever amongst troops in this country from those of other fevers, and even since that year the returns have at times presented such discrepancies as to suggest that what was designated enteric fever in one Presidency was included amongst the returns of continued and remittent in others. For several years past a comparative statement of these returns has been given in this report in the subjoined form, from which it will be seen that if the figures for the eleven years, 1871 to 1881, be carefully followed, a very intimate relation exists between the death-rate from the two groups of fevers:—

Statement showing the death-rate from Fevers per 1,000 of strength among the European Troops of the Three Presidencies from 1871 to 1881.

Presidency.	Fevers.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	1880.	1881.
Bengal	Intermittent, remittent, and continued.	2·25	1·78	1·39	1·10	1·18	0·71	0·66	1·59	3·90	3·44	0·81
	Enteric	1·71	1·62	1·53	2·01	1·59	1·75	1·55	4·69	4·59	3·69	2·62
	Total	3·96	3·40	2·92	3·11	2·77	2·46	2·21	6·28	8·49	7·13	3·43
Madras	Intermittent, remittent, and continued.	0·83	0·69	0·70	0·17	0·36	0·46	0·27	1·11	0·76	0·39	0·19
	Enteric	1·47	2·34	0·78	1·04	0·63	1·99	2·00	1·20	1·44	1·36	0·58
	Total	2·30	3·03	1·48	1·21	0·99	2·45	2·27	2·31	2·20	1·75	0·77
Bombay	Intermittent, remittent, and continued.	1·01	0·74	0·56	0·76	1·28	0·29	0·50	1·12	1·61	3·23	0·91
	Enteric	1·48	2·22	1·31	1·33	1·77	1·86	1·39	2·55	1·93	5·76	2·83
	Total	2·49	2·96	1·87	2·09	3·05	2·15	1·89	3·67	3·54	8·99	3·74

If the ratios be thrown into the form of a diagram, it will be observed that as regards Bengal, for example, the intermittent, remittent, and continued fever-curve runs a closely similar course with that of enteric fever throughout the entire period. From 1871 to 1877 the mortality ratios of both groups are low. In 1878 and 1879 the enteric fever-curve goes very high; that representing the course of the other group of fevers also rises considerably in 1878, and still more so in 1879, until the ratios in both groups become nearly identical. The mortality from both classes of fever continued to be very high during 1880, and in 1881 a diminution occurs in both classes. The Bombay returns show an equally striking correspondence as to the mortality ratios from both classes of fever. From 1877 to 1880 the figures become more and more unfavourable, and in 1881, just as was the case in Bengal, the ratios of both groups show improvement. In Madras the correspondence is not so striking, but, as has been more than once observed in this Office Annual Report, the returns from this Presidency for some of the years of the period for which comparative data are available appear to have been influenced by the opinion held by the then Surgeon-General, Her Majesty's Forces, in that Presidency, that enteric fever does not occur amongst European soldiers in India.

Enteric fever.

During the ten-year period 1870–79, the admission and death-rates from enteric fever were higher in Bengal than in either of the other Presidencies, the mortality having been 2·28 per 1,000 against 1·75 in Bombay and 1·42 in Madras. During the last two years, however, Bombay has occupied the highest place in this respect, 5·76 in 1880 and 2·83 in 1881, against 3·07 and 2·62 for the same annual periods in Bengal. Both as regards admissions and deaths the ratio in Bombay during 1881 was less by over one-half what it was in 1880. In Madras the returns for the year under review are still more favourable, as may be learnt from the following statement:—

Period.	Bengal.						Madras.						Bombay.					
	Admissions per 1,000.			Deaths per 1,000.			Admissions per 1,000.			Deaths per 1,000.			Admissions per 1,000.			Deaths per 1,000.		
	Enteric Fever.	Other Fevers.	Total.	Enteric Fever.	Other Fevers.	Total.	Enteric Fever.	Other Fevers.	Total.	Enteric Fever.	Other Fevers.	Total.	Enteric Fever.	Other Fevers.	Total.	Enteric Fever.	Other Fevers.	Total.
1870—79 -	5·3	607·3	612·6	2·28	1·74	4·02	3·9	266·5	270·4	1·42	0·63	2·04	3·1	659·9	663·0	1·75	1·14	2·89
1880 -	3·7	809·6	813·3*	3·07	2·66	5·73*	2·6	450·1	452·7	1·36	0·39	1·75	9·5	1,117·3	1,126·8	5·76	3·23	8·99
1881 -	6·3	763·9	770·2*	2·62	0·81	3·43*	0·9	278·7	279·6	0·58	0·19	0·77	4·2	840·6	844·8*	2·83	0·91	3·74*

* Excluding troops in Afghanistan.

Cases of enteric fever were returned in most of the stations of the Bombay Presidency, though in many of them there was only a single case. The disease was consequently very widely distributed, though the number of cases throughout the Presidency was by no means large as compared with the strength of the army. Of the 227 admissions from the disease, however, 109, or nearly one-half, occurred in six stations,—at Lucknow 46, Rawalpindi 15, Bareilly 14, Meean Meer 12, Dum-Dum 12, and at Banikhet 10. Amongst these 109 admissions, 33 deaths occurred, a little over one-third of the total deaths. Meerut contributed largely to the mortality from the disease, seven deaths out of nine cases.

As regards the relation which exists between enteric fever in this country and age and length of residence, the following abstracts furnish a summary of the more important figures. The first gives the composition of the army according to age for the last 11 years, from which it will be seen that during 1881, 43 per cent. of the strength of the army in India was under 25 years of age, a larger proportion of very young men by 10 per cent. than was the case five years previously. On the other hand, the proportion of men of 30 and over has gradually diminished, and now stands at 22 per cent. of the strength.

Year.	Under 25.	25 to 29.	30 and upwards.	
1871—75 - - -	38 per cent.	27 per cent.	35 per cent.	= 100
1876 - - - -	38 ,,	32 ,,	34 ,,	= 100
1877 - - - -	33 ,,	35 ,,	32 ,,	= 100
1878 - - - -	35 ,,	36 ,,	29 ,,	= 100
1879 - - - -	39 ,,	33 ,,	28 ,,	= 100
1880 - - - -	41 ,,	34 ,,	25 ,,	= 100
1881 - - - -	43 ,,	35 ,,	22 ,,	= 100

In 1880 there were in the army of India 143 deaths from enteric fever amongst men under 25 years of age, which was equivalent to a proportion of 6·25 per 1,000 of the strength at that age; whereas amongst men above 25 there were only 74 deaths, or equivalent to 2·22 per 1,000, so that men under 25 were about three times more susceptible to the disease than the remainder of the army. In 1881 the great susceptibility of young men to enteric fever is again clearly shown; for, whereas the death-rate among men under 25 years of age was 4·56, that among those between 25 and 29 years of age was only 1·57. Some of these statistics are given in the subjoined abstract.

Statement showing the death-ratios of the European Army from Enteric Fever at different Ages and different Periods of Residence in India, together with Ratios of Liability to it for 1877—81.

Year.	Mortality from Enteric Fever, and Ratio of Liability to it at different Ages.						Mortality from Enteric Fever, and Ratio of Liability to it at Different Periods of Residence in India.					
	Under 25.		25 to 29.		30 to 34.		1st and 2nd Years.		3rd to 6th Year.		7th to 10th Year.	
	Deaths per 1,000.	Percentage of Liability.	Deaths per 1,000.	Percentage of Liability.	Deaths per 1,000.	Percentage of Liability.	Deaths per 1,000	Percentage of Liability.	Deaths per 1,000.	Percentage of Liability.	Deaths per 1,000.	Percentage of Liability.
1877 -	2·45	44·2	1·55	27·9	0·99	17·8	3·31	59·5	1·35	24·2	0·90	16·1
1878 -	6·04	53·0	3·56	31·1	1·04	9·1	7·90	63·4	2·64	21·2	1·38	11·0
1879 -	6·17	54·1	2·73	23·9	1·78	15·6	7·99	67·2	2·18	18·3	1·24	10·4
1880 -	6·25	56·26	3·15	28·35	1·09	9·81	9·08	75·98	1·78	14·90	0·47	3·93
1881 -	4·56	59·84	1·57	20·60	0·79	10·37	4·55	60·02	2·07	27·31	0·56	7·39

For some years past attention has been drawn in this Office Annual Reports to the apparent connexion existing in this country between enteric fever, youth, and non-acclimatisation. In the section of the report of the Army Medical Department for 1875, dealing with the results in the Bombay Presidency for that year, the question of the effect of acclimatisation as regards enteric fever referred to is as follows :—

The relation between the prevalence of enteric fever and locality is obscured by the evidence of its relation to periods of residence in the command, or, in other words, the immensely greater susceptibility of new comers to contract this disease, than that existing in the case of those whose susceptibility may have been weakened by the influence of a longer exposure to its exciting cause. In the present year, two corps, having together a strength of 1,839 non-commissioned officers and men, arrived in the Bombay command from England; the admissions from enteric fever amongst them were 25, being in the rate of 13·6 per 1,000 men. In the other corps in the command, having a strength of 8,503 non-commissioned officers and men, there were 17 admissions for enteric fever, being in the rate of two per 1,000; but in these corps were 401 men newly arrived from home, and it was in this small number that most of the 17 attacks of enteric fever occurred.

As a natural consequence of the annually increasing proportion of young men in the army of India, it follows that the proportion of acclimatised soldiers is much diminished. The year under review brings out this fact more strikingly than any of the preceding ten years, as may be seen from the following statement, in which the proportion of men who have served in the country for two, five, and seven years is entered :—

Statement showing the Proportion of Men who have served in India Two, Five, and Seven Years, from 1871—81.

Period.	Percentage of Men to Total Strength who have served in India.			Period.	Percentage of Men to Total Strength who have served in India.		
	Two Years and under.	Five Years and under.	Seven Years and under.		Two Years and under.	Five Years and under.	Seven Years and under.
1871 - -	36·2	64·6	78·9	1876 - -	25·5	57·6	75·1
1872 - -	33·7	66·7	80·0	1877 - -	25·2	56·2	72·6
1873 - -	31·7	66·5	79·6	1878 - -	28·9	59·8	73·0
1874 - -	25·9	64·3	79·8	1879 - -	32·1	60·9	72·6
1875 - -	26·1	60·1	81·0	1880 - -	33·4	65·4	77·2
				1881 - -	38·9	70·4	81·1

The distribution of the enteric fever deaths according to residence was as follows :—

Two years and under - - -	4·55 per 1,000
3rd to 6th year - - - -	2·07 „ „
7th to 10th year - - - -	0·56 „ „
10th year and upwards - - -	0·40 „ „

It will be observed that 38·9 per cent., or considerably more than one-third, of the army had not served in India above two years, which is 5½ per cent. higher than the proportion in 1880, and some 13 per cent. higher than the proportion five years previously. From what has been said in this and the preceding paragraph, it follows that, both as regards age and acclimatisation, the troops in 1881 were in a more favourable position than in 1880, or in any other year of which we possess satisfactory records. Notwithstanding this, the death-rate from enteric fever fell from 3·63 to 2·64 per 1,000, but the death-rate from all causes fell in an even greater proportion—from 28·32 in 1880 to 16·86 in 1881. It would, therefore, appear that the prevalence of enteric fever even among young men new to India is greatly dependent on the general character of the year —whether it is healthy or unhealthy. It has long been observed that the season of its most marked prevalence in this country is that which is associated with the greatest heat; and the late Dr. Bryden was strongly of opinion that this relation is more than a coincidence. The connexion is more apparent in Upper India than it is in either Madras or Bombay, that is to say, in the part of the peninsula where a more strongly marked difference exists between the hot and the cold season. In those part of the country where the temperature, though high, is tolerably equable throughout the year, enteric fever, as judged by monthly returns, is more evenly distributed.

For some years past special inquiries have been instituted in the three Presidencies, with the object of tracing the origin of the disease to a distinct cause, and reports have been received regarding every fatal case of enteric fever which has occurred among the troops. Owing, however, to the barrenness of the results, it was decided last year that in Bengal these special reports should be discontinued, recourse being had to the ordinary

annual and casualty reports for any information that can be had. In the meantime the special reports from the Madras and Bombay Presidencies are to be continued.

That in several stations of the Bengal Presidency earnest endeavours have been made to trace the origin of enteric fever to some cause, is abundantly evident from the annual reports of the medical transactions of the various regiments which have been placed at the disposal of this office by the Surgeon-General, Her Majesty's Forces. At Ranikhet, for example, Surgeon-Major Gore has furnished a full account of the enteric fever cases which occurred at that station amongst the men of the 30th Regiment. In last year's annual report, an account was given of the history of this regiment from notes which had been prepared by Dr. Lewis, as a result of personal inquiry. The regiment had landed in Bombay in February, 1880, and detachments had been distributed to Shahjahanpur and Moradabad, whilst the head-quarters proceeded to Ranikhet. Cases of enteric fever occurred in each sub-division of the regiment. In 1881 there were eight cases more, and three deaths, amongst the men at Ranikhet—all but one man having been less than two years in India. The last case in 1880 occurred in November, and the first case amongst the men in 1881 was admitted on the 30th May. Regarding the probable causation of the disease at this station, Dr. Gore writes: "Nothing very definite could be traced. The cases came "from barracks widely separated. In two, some local insanitary conditions appeared to "have been pre-existing, but in one of these the patient felt ill immediately after a "shooting excursion, and the other after a cricket match. One man appeared to have "contracted the disease in hospital, the remainder were admitted from blocks whose "filters and latrines were in good order, and where there was nothing objectionable in "the immediate surroundings at all events. Of this fact I satisfied myself by a personal "inspection. One of the men drank no milk at all, and the others only a little in their "tea. The water-supply at its source is certainly good, and no traces of organic "or sewage contamination were detected on rough analysis. A mere trace of chlorides "occurred only in the water. Allowing that a latrine was faulty, it is difficult to "conceive how only one, out of several who frequented it, was affected with fever. The "probabilites are altogether adverse to the supposition indirectly supported by the fact "of men being admitted from blocks where there were no defects in the latrines. A "water epidemic would have been more general and sudden at Ranikhet, for the water "is distributed from a single source of supply, or supposed to be. So would have been "an outbreak of 'milk typhoid,' but the milk seems to be 'put out of court' altogether "by the following facts:—1, that the men who used it most sparingly were principally "attacked; 2, that, with a single exception, the women and children who used it in "largest quantities, and from the Sudder Bazaar, escaped altogether; 3, that a man "who never took any milk contracted the disease; 4, that there was no evidence to "show that the milk had been diluted with *impure* water, and enteric fever is almost "certain not to have prevailed in the surrounding villages; 5, because the cases were "sporadic and not connected with each other, and arose at irregular intervals with the "same milk supply; 6, because the Hindus generally use bazar milk largely diluted "with water, and apparently suffer no ill effects."

Brigade Surgeon Tulloch, in referring to the case of a young soldier at Sialkot who had arrived in India last cold season, says: "A solitary case occurring among some "400 men, all subject to the same influences, and existing under the same conditions, "offers little chance of throwing light on the origin of the disease, unless some departure "from the general course can be shown to have taken place. In this instance nothing "in this direction could be determined, and the question why one man out of 400 should "be attacked with enteric fever and 399 escape, remains unanswered." Again, Surgeon-Major Berkeley, writing as to the possible cause of the disease amongst men under his charge at Lucknow, says: "I can come to no other conclusion than that the disease was "not induced by any insanitary cause existing in the lines," and that "there is no reason "to believe that the disease was introduced by the milk used by the men, care always "being taken that milk of good quality was issued; and of this even the quantity taken "back was very small and obtained fresh in the lines."

Reporting on the epidemic of enteric fever which occurred during May and June amongst the men of the Border Regiment at Dum-Dum, Surgeon-Major Wade writes: "There were eleven cases, all in young soldiers and under one year's residence in India. "Every care was taken in investigating each case as it occurred, and it was found "impossible to associate it directly or indirectly with fæcal contamination of food or "water, or with any primary source of infection. There was no question of accuracy of "diagnosis in these cases as genuine enteric fever, as, unfortunately, three proved fatal, "and the *post-mortem* examination exhibited ulceration and infraction of the Peyerian "and agminated glands."

The reports of several other medical officers might be cited, in which similar opinions are more or less expressed; indeed in the majority of instances, where the reporters give evidence of having conducted a close personal inquiry, the foregoing examples may be looked upon as a fair illustration of the results generally. In other instances, however, opinions are less cautiously expressed as to the probable cause. One illustration of this will suffice. Regarding the probable cause of the cases which occurred amongst the men of the Northumberland Fusiliers at Agra, the officer in medical charge writes: "The "source was supposed to have been the milk-supply, and there is no doubt that at one "time of the year a supply of this was being imported of an inferior quality, the number "of cows milked on the premises being quite insufficient to meet the demands." This regiment arrived at Agra from England in February 1880, and five cases of enteric fever occurred amongst the men during that year. In the year under review five more cases, with three deaths, occurred. In previous annual reports special reference was made to the occurrence of the disease at Agra. With regard to the cases which took place in the fort, it was shown that the milk theory of causation was excluded by the circumstance that the cows were brought into the fort to be milked under supervision; and as to the other cases in the station being due to such a cause, it was stated that it had been advanced that, "were the milk to blame, the disease would appear amongst the "women and children, who consume large quantities of it; whereas the fact is not one "of them has been admitted with fever." A like result would appear to have been experienced during 1881, no deaths having been ascribed to this disease amongst either the women or the children.

In a special report on the cases of enteric fever which occurred in the Madras Presidency during 1881, Surgeon-General Madden, in considering the causes of them writes: "In the year under review the attention given to the sanitary surroundings, and "the food and drink of the troops, was, as usual, systematic and continuous. In six out "of the nine cases recorded, the origin of the attacks could not be connected with any "insanitary conditions, and in three instances certain points were noticed in connexion "with their history as possible causes." No very definite opinion, however, appears to have been expressed by any of the reporters as a result of personal inquiry.

Writing of the cases of enteric fever which occurred amongst the troops in the Bombay Presidency during the year, the Surgeon-General, Her Majesty's Forces, expresses himself as follows:—"As regards the means by which enteric fever is propagated among "the troops in this country, there has been no addition made to our knowledge since the "date of last report." The remarks referred to are probably those quoted in paragraph 42 of this Office Annual Report for 1880, concluding with the following sentence: "In no instance of the cases recorded could the disease be traced to any certain cause "—known sanitary defects do not exist in or near the troops' lines; but in most of the "bazaars and native villages the conditions are to be found favourable to the production "of enteric fever. These are believed to be malaria and exposed fæcal deposit."

Dengue. So far as our statistical records show, dengue was observed for the first time in this country in 1872. In that year the troops in the three Presidencies suffered from this disease, and it continued amongst them till the following year. During 1874 and 1875 no cases were returned as dengue, but in 1876 the disease reappeared and gave rise to 669 admissions in Bengal and to six in Madras. From this period no further admissions were recorded, until the year under report, when 120 were reported as having occurred in Bengal, chiefly in those stations which are situated in the Gangetic provinces. The first case recorded in 1881 occurred in February, and there were further cases until September. The maximum number in any one month, 61, occurred in October; in November there were 15 cases, and in December only three.

Bowel complaints. In 1881 the admission and death-rates from bowel complaints in the army of India equalled 89 and 2·04 per 1,000 respectively, which is about half what they were in the preceding year, the admissions in that year having been 136 and the deaths 4·27. As will be seen from the table at p. 52, the figures for Bengal and Bombay during the year under review are more favourable than during 1880. In Madras the figures for 1881, under both heads, are not so favourable as for the preceding year, though they show a marked improvement over those of the ten-year period, 1870–79.

Apoplexy. As regards appoplexy also, the admission and death-rates in the army of India during 1881 were about half what they were during 1880, 3·9 and 1·48 per 1,000 respectively, against 6·7 and 2·69. In 1879 and 1880 cases of apoplexy and sunstroke were very numerous amongst the troops in the Punjab, owing to the large proportion of men who were exposed in camp or on the march during that period. During the year under report, the mortality from this cause in the Punjab fell to less than half what it was in

1880. The largest number of deaths at any one station during 1881 occurred in one of the garrisons of the Punjab group, at Meean Meer, where 12 deaths from apoplexy out of 26 admissions were registered. The admissions were lower in all the Presidencies, and in Bengal and Bombay the deaths were nearly half what they were in 1880, while in Madras the mortality was slightly higher, though the ratio itself was lower here than in either of the other two Presidencies.

Hepatitis.

Of the chief diseases, hepatitis was the only one which, during 1881, yielded a higher death-rate than the preceding year,—1·60 per 1,000 against 1·34. The increase was, however, very trifling, and the admission-rates are nearly identical. In Madras hepatic diseases in former years have prevailed to a greater extent than in the other Presidencies. The returns during the last two years have been very favourable, and especially so as compared with the average annual admission and death-ratios of the preceding ten-year period.

Respiratory diseases.

During the year under review there were 103 deaths from diseases of the respiratory organs in the army of India, against 175 in 1880. The number returned from any single station during 1881 was not large, and the ratios for each of the three Presidencies were lower than in the preceding year. As compared with the ten-year period 1870–79, the figures for Bengal and Madras do not present any marked difference; but the ratios for Bombay are somewhat higher. In 1880 the Bombay statistics under this heading were very unfavourable, but this was owing to their having included the troops in Afghanistan.

Working of lock hospitals.

For a number of years the Lock Hospital system has been very generally enforced in the cantonments of the three Presidencies, but year by year it becomes more and more evident that, however successful such a system promised to be when it was originally adopted, its practical working in this country has proved a complete failure. Taking the statistics of the last 12 years, during which the returns of the army of the three Presidencies have been tabulated on the same plan, and during which period also the Lock Hospital system has been very generally adopted, it is found that the admissions into hospital from venereal diseases are as great as ever. Indeed, the ratio of the year under review for the army of India, 260 per 1,000, is, with the single exception of that for 1878, the highest on record. It is 10 per 1,000 higher than it was in 1880, and 57 higher than was the average annual ratio of the preceding 10 years, 1870–79. In the Bengal Presidency the admission-rates during 1880 and 1881 were 67 per 1,000 higher than the average of the preceding decennium; and 10 per 1,000 higher than the annual average ratio of the period 1860–69, which comprises several years during which there were no lock hospitals, and terminates before the system had been so generally introduced as it has been since. What has been said regarding the results of the working of the system in Bengal may, so far as data are available, be said with equal truth regarding those of Madras and Bombay, as may be gathered from the following summarised comparative statement:—

Admissions from Venereal Diseases in the Three Presidencies.

Province.	Admissions per 1,000.			
	1860–69.	1870–79.	1880.	1881.
Bengal	265	209	276*	276*
Madras	—†	198	275	253
Bombay	—†	191	269	261*
India	—	203	250	269

* Excluding troops in Afghanistan. † The statistics of Madras and Bombay for these years are not available.

Invaliding.

Two thousand two hundred and forty-one men of the army of India were invalided during the year, which is equal to 38·36 per 1,000 of the strength. The statistics of invaliding for 1880 were incomplete, owing to non-receipt of the returns of several corps, and consequently no satisfactory comparison can be made under this head between the figures of the year under report and those of the previous year. The ratio of invaliding which was returned for 1880, 26·31, was considerably below the truth. Of the total of 2,241 men invalided in 1881, 778 were recommended for discharge from the service and 1,463 for change. During the 10 years, 1870–79, the ratios of invaliding from all causes have varied from 38·90 in 1876 to 51·02 in 1870; and the annual average for the period was 43·04, or about 4½ per 1,000 higher than the ratio for 1881.

The proportion of invaliding in the three Presidencies was as follows:—In Bengal the ratio was 36·92, in Madras 27·91, and in Bombay 53·35. The average annual ratios during the ten-year period, 1870–79, were 41·40 in Bengal, 48·71 in Madras, and 42·79 in Bombay. It will thus be seen that the ratio for 1881 in Bengal was somewhat lower than the ten-year average, and that it was very much lower in Madras. In Bombay it was more than 10 per 1,000 higher.

After "anæmia and general debility" the chief causes of invaliding in the army of India during the year were hepatitis 2·96 per 1,000, dysentery and diarrhœa 2·83, and phthisis 2·21. In Bombay a considerably larger proportion was invalided from fevers and bowel complaints, though possibly these diseases may have been to a larger extent included under "anæmia and general debility" in the other Presidencies, and thus less prominence been given to them than in Bombay.

Influence of age and length of service.

Of the total number invalided in the army of India during 1881, 33·74 per cent. were under 25 years of age as compared with 35·84 per cent. in 1880; and 34·58 per cent. were from 25 to 29 years of age as compared with 30·23 during the same period. As already remarked, however, the invaliding statistics for 1880 were not sufficiently complete to permit of satisfactory comparisons with those of other years. With regard to the effect of residence in the country, it is to be remarked that 14·00 per cent. of the total invalided had been less than two years in India, and 30·20 per cent. had served in the country from two to five years. The percentages during 1880 for the same ages were 31·12 and 36·54 respectively.

The sanitary statistics of regiments also are materially affected by the length of time they have been in India. From the subjoined abstract it will be seen that under every heading, with the exception only of hepatitis, the statistics of newly-arrived regiments were more unfavourable than those of the army generally. The total death-rate was nearly 6 per 1,000 higher, and the death-rate from enteric fever 8 per 1,000 higher.

Experience of newly-arrived Regiments in 1881.

—	Strength.	Ratio per 1,000 of Strength.							
		Admission-rate.	Daily sick-rate.	Death-rate.	Deaths from: Enteric Fever.	Other Fevers.	Apoplexy.	Dysentery and Diarrhœa.	Hepatitis.
Army generally -	58,728	1,605	70	16·86	2·64	·72	1·48	2·04	1·60
New Regiments -	5,542	1,814	75	23·64	10·65	·90	1·80	2·17	1·08

Intemperance.

The returns intended to show the extent of intemperance among European troops in the three Presidencies have been discontinued, and it is thus no longer possible to give the information on this subject which has been given in former reports. Had the information been accurate the want of it would be a serious loss, but the marked discrepancies in the figures regarding different regiments afforded strong evidence that the returns were not prepared on a uniform principle, and that they were consequently of little value as an index of the extent of intemperance.

Sickness and mortality among women and children.

During the ten-year period, 1870–79, the average annual strength of the women in the army of India was 6,029, and that of the children 11,162. During the period the mortality amongst the women equalled 25·61 per 1,000, and that amongst the children 69·04. From 1875 there has been a gradual decrease in the number both of women and children, until in 1881 they numbered 3,741 and 6,548 respectively, or little more than half what they did in 1875, namely, 6,335 and 12,359.

The death-rate of the year amongst women, 25·93, was nearly 5 per 1,000 higher than it was in 1880, but the mortality amongst the children, 60·17, was nearly the same as in the preceding year. The chief cause of the increased death-rate amongst the women was cholera, from which disease 4·91 per 1,000 died, against 1·69 in 1880. Enteric fever contributed only three deaths amongst the women, or 0·80 per 1,000 against 2·64 amongst the men.

As regards the mortality amongst women in the different Presidencies, Bengal occupies the highest place, with 29·30 per 1,000; Bombay comes next with a ratio of 24·60. In Madras the death-rate was 18·89. The Presidencies stood in the same order in this respect last year. Of the fifteen deaths from cholera which occurred amongst the women of the whole army in 1881, 10 took place in Bengal, five having occurred at a

family camp in the Murree hills. There were no deaths from enteric fever recorded amongst the women either in Bombay or Madras.

The three Presidencies stand in the same order as regards the mortality amongst children as they stand in regard to the mortality amongst women—Bengal 67·17, Bombay 66·56, and Madras 38·68. In 1880 the ratios for the Presidencies were 66·56, 51·58, and 51·77, respectively. The ratios of both these years are lower than the average annual death-rate for the preceding decennium, 75·57 for Bengal, 67·51 for Bombay, and 55·32 for Madras.

Amongst the death causes of children convulsions stood highest; to this, indeed, about one-sixth of the total deaths was ascribed. Diarrhœa stood next, under which heading, along with dysentery, another sixth of the mortality has been returned. The remaining two-thirds of the deaths were due, in order of frequency, to debility, bronchitis, measles, dentition, fevers, and other causes. There were 20 admissions, with nine deaths, from cholera in Bengal, but none in Madras or Bombay. There was not a single death from small-pox amongst the children of the whole army. The same immunity was observed during 1880.

The average annual mortality amongst children during the ten years 1870-79, 69·04 per 1,000, was made up chiefly of the following: convulsions 11·17, diarrhœa 12·84, anæmia and atrophy 7·97, detention 7·31, &c. The death-rate from cholera was 2·64, from measles 2·58, and from small-pox only 0·20.

Mortality of Officers.

Out of 3,713 officers of both services borne on the strength of the army of Bengal, either serving in the country or on leave, 70 died, which is equivalent to 18·85 per 1,000. In 1880 the death-rate recorded was 21·96. The ratio for officers of the British service during 1881 was 20·10 against 23·93 in 1880, and that for officers of the Indian service was 17·48 against 19·79, respectively, for the same periods.

Native Troops.

Sickness and mortality among Native troops.

It is satisfactory to have to record that the mortality amongst the native troops of the army of India during 1881 was but little more than one-half what it was in 1880 or 1879. During the last five years the statistics of these troops for each of the three Presidencies have been prepared in this office—1877 to 1881—and a summary of the principal data is given in the subjoined tabular statement:—

Year.	Ratio per 1,000 of					Mortality including Absent Deaths.
	Average Strength.	Admissions into Hospital.	Daily Sick.	Deaths from		
				Cholera.	All Causes.	
1877	113,966	1,030	32	1·58	10·90	13·38
1878	117,273	1,460	43	2·06	18·04	21·02
1879	121,107	1,735	58	4·61	35·15	37·79
1880	126,385	1,545	56	0·63	39·22	41·12
1881	114,612	1,305	46	0·97	19·24	22·62
Means of the five years	118,669	1,422	48	1·94	24·90	27·40

From the above it will be seen that the total mortality, including the deaths which occurred amongst men absent from their corps, fell from 41·12 per 1,000 in 1880 to 22·62 in 1881; and the ratio amongst men actually present with their regiments fell from 39·22 to 19·24 in 1881. Moreover, the admission-rate declined from 1,545 to 1,305, and the daily sick-rate from 56 to 46. Under every heading the ratios for 1881 are considerably lower than the means of the quinquennium ending with that year.

Speaking generally, nearly half the admission-rate was due to paroxysmal fevers, and one-third of the death-rate, or 6·52 per 1,000, was due to diseases of the respiratory organs. The mortality from this cause may be due, in great part, to complications arising in the course of malarial disease. Of the death-rate of the year, 2·76 per 1,000 is ascribed to fevers of all kinds—316 fever casualties, of which 11 were returned as enteric. There were 111 deaths from cholera against 67 in 1880, and 578 in 1879. The remarkably small mortality from small-pox amongst native troops is to be accounted for by the fact that most of the men have already had the disease in early life. In 1879 there were 11 deaths recorded from this disease, 15 in 1880, and only 12 in 1881.

Bengal army.

About one-third, or 38,721 men of the native army of India, belong to the Bengal Presidency, and of these nearly 2,000 were on service in Southern Afghanistan. With regard to the troops in cantonments, the statistics for 1881 compare very favourably with those of the preceding year; the admissions were 1,495 against 1,609, the daily sick 51 against 65, and the mortality 19·76 against 33·85. Even the comparatively favourable ratios of 1881, though lower than those of the preceding three years, are, nevertheless, higher than the averages under the same headings of the ten-year period 1867–76, as will be seen from the following statement, in which the leading features of the statistics of this period are given along with those of subsequent years:—

Year	Average strength.	Ratio per 1,000.				Mortality, including absent Deaths.
		Admissions into Hospital.	Daily sick.	Deaths from		
				Cholera.	All causes.	
1867–76	395,081	1,360	42	2·12	13·84	17·25
1877	39,649	1,097	34	0·35	10·32	13·63
1878	41,116	1,645	49	2·09	22·59	25·57
1879*	31,116	2,023	68	2·80	31·78	53·61†
1880*	30,365	1,609	65	1·52	33·85	53·15†
1881*	36,896	1,495	51	0·92	19·76	27·73†

* Excluding troops in Afghanistan.
† These ratios are calculated on the total regimental strength, including the army in Afghanistan.

There was a diminished mortality in this Presidency under nearly every heading during 1881, though the decrease was most marked under respiratory diseases, from 7·21 in 1880 to 6·59 per 1,000 in 1881; fevers from 9·19 to 3·12, and bowel complaints from 6·13 to 2·74. There was also a decrease in the mortality from cholera 0·92 against 1·52. Six cases of enteric fever, with three deaths, were returned during 1881, and 19 cases of small-pox with only one death.

Of the five geographical groups into which the cantonments of this Presidency have been divided, the Agra and Central India group presents the lowest death-rate, 9·35 per 1,000, and also the most marked decrease as compared with the ratio of 1880 was 28·52. In every group, however, there has been a marked decrease in the death-rate, and in nearly every group the admissions into hospital were lower than they were during 1880, as will be seen from the subjoined statement for a series of years:—

Year.	Ratio per 1000.									
	Bengal Proper and Assam.		Gangetic Provinces.		Rohilkund and Meerut.		Agra and Central India.		Punjab.	
	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.
1867–76	1,522	14·13	1,061	8·38	987	11·19	1,588	9·61	1,459	14·24
1877	1,491	19·64	768	5·19	641	9·52	905	7·41	1,248	8·85
1878	1,527	22·13	1,036	7·88	1,007	9·83	1,580	12·96	1,896	18·33
1879	1,816	25·57	1,658	11·06	2,038	36·17	2,302	16·07	2,172	47·64
1880	1,757	40·63	1,222	20·50	1,395	24·46	1,884	28·52	1,687	38·02
1881	1,772	22·53	1,260	15·78	1,378	15·67	1,380	9·35	1,521	28·86

It will be observed that, as regards the Punjab especially, a most satisfactory improvement took place, both in respect to admissions and deaths, when compared with the ratios of the two preceding years. The admissions amongst the troops in Bengal Proper and Assam continue to be high, though the mortality, 22·53, is but little more than half the ratio for 1880.

Fevers occupy the first place as causes of admissions into hospital, and the highest ratios from these were returned from the Bengal Proper and Assam groups. In this group, also, bowel complaints were from two to four times more prevalent than in the other groups. Respiratory diseases likewise, were exceedingly prevalent in this group, and all the other forms of sickness in which malaria plays a prominent part. This feature in the sanitary history of the group will be seen from the figures in the subjoined table, which also gives the chief causes of admissions into hospital in all the groups:—

Groups.	Ratio of Admissions per 1,000 of Strength.					
	Fevers.	Bowel Complaints.	Spleen Disease.	Respiratory Disease.	Rheumatism.	Abscess and Ulcer.
Bengal and Assam	862	204	24	104	51	121
Gangetic Provinces	612	73	22	61	52	111
Rohilkund and Meerut	681	50	9	65	51	135
Agra and Central India	687	49	15	62	42	133
Punjab	871	39	14	91	42	107

The malarial character of the diseases in the Bengal and Assam group becomes even more evident from an examination of the mortality returns; for, out of a total death-rate of 22·53 per 1,000, fevers, bowel complaints, and respiratory diseases contributed in very nearly equal proportions, just one-half. The death-rate in the Punjab was almost identical with that in Bengal and Assam, but here nearly half the total ratio was contributed by respiratory diseases alone. In 1880, also, the mortality from this cause was very high in this group of cantonments. There were no deaths from cholera in the Agra and Central India group, and the mortality from this disease in the Punjab was only half what it was in 1880. As regards dysentery and diarrhœa, also, the ratio has fallen from 7·76 to 2·92.

Chief Causes of Mortality in the several Groups of Cantonments of the Bengal Presidency during 1881.

Groups.	Ratio per 1,000.				
	Cholera.	Fevers.	Bowel Complaints.	Respiratory Diseases.	Total.
Lower Bengal and Assam	1·23	3·83	3·99	3·83	22·53
Gangetic Provinces	1·35	2·03	1·70	2·20	15·78
Rohilkund and Meerut	1·25	2·80	2·00	5·43	15·62
Agra and Central India	...	4·25	0·62	4·65	9·35
Punjab	0·68	3·79	2·92	10·13	22·86

As regards the admission-rates at the individual stations of the Presidency, Dharmsala stood highest, with a ratio of 2,752, of which 2,142 were from fevers. Of the other larger stations, Delhi returned the next highest ratio, 2,732, over 2,000 per 1,000 in this instance also having been from fevers. Four other of the larger stations returned admission ratios of over 2,000—Meean Meer, Alipore, Barrackpore, and Dinapore.

As regards mortality, two stations returned a death-rate amongst men present with their regiments, of over 50 per 1,000 during 1881—Nowshera 53·18, and Fyzabad 50·82. At Nowshera, out of a total of 41 deaths, 22 were ascribed to fevers and 12 to respiratory diseases. At Fyzabad, out of a total of 34 deaths 13 were registered as due to splenic disease and to anæmia and debility, 4 to bowel complaints, and 3 to fevers. In 1880 the mortality at Fyzabad was 96·97, or nearly twice the high ratio of the year under report. None of the other stations call for any special remarks except Peshawar and its outposts, where out of a total of 90 deaths, 55, or considerably more than one-half, were ascribed to diseases of the respiratory organs.

The statistics of the Bengal troops on service in Southern Afghanistan show a very high mortality. Of the 1,825 men who were thus employed, 194 died during the year, equal to a ratio of 106·30 per 1,000, or more than five times the average amongst the Bengal troops in cantonments. Of the total deaths 55 were due to respiratory diseases, and 57 to bowel complaints; considerably more than half the total mortality was therefore returned under these two headings. The deaths from paroxysmal fevers were also numerous, 24; and anæmia and debility, 11. By adding the deaths from these causes, it will be seen that 147 of a total of 194 were due, more or less directly, to malarious influences. There was no cholera and no enteric fever amongst these troops; and only one death from small-pox. The admission-rate, 1,475 per 1,000, was by no means high, as compared with the excessive mortality; for, as will be seen from the above cited table, the percentage of the deaths to the cases treated was, in several instances, exceedingly high. It may be noted that there were no admissions from guinea-worm.

The statistics of the Punjab Frontier Force show that out of an average strength of about 10,000 men in cantonments, there were 185 deaths during the year—equal to 17·95 per 1,000, about 6 per 1,000 lower than the ratio for 1880, and 14 per 1,000 lower than it was in 1879. Among the principal causes of mortality, diseases of the respiratory organs occupy the highest place, as they were also the principal causes of mortality amongst the troops, both European and Native, serving in the Punjab Frontier. Nearly one-half the total mortality, or 88 deaths, were attributed to these diseases; 24 were returned as due to intermittent, remittent, and continued fevers, in addition to which five deaths, out of six admissions, were ascribed to enteric fever. Three of these deaths from enteric fever occurred at Kohat and outposts.

On the whole, the most favourable statistics furnished by any corps in India during 1881 were those of the Hyderabad Contingent and of the Central India Regiments. With regard to the latter, the sick-rate was only 26, and the admissions only 815 per 1,000. Out of a strength of some 5,000 men, there were only 61 deaths, or equivalent to 12·11 per 1,000, a ratio less than half what it was in 1879 or 1880. Nearly one-half, or 27 of the total deaths were due to respiratory diseases; 12 to fevers, one being from enteric fever; and the remainder to the usual causes of mortality. There was no case of cholera, and only three cases of small-pox, with no death, during the year. There were 152 admissions from guinea-worm, 99 of which were admitted during March, April, May, and June. During the two first and the four last months of the year there were only 17 such cases admitted into hospital.

The statistics of the Hyderabad Contingent are even more favourable than those of the Central India Regiments. The mortality of the year, 7·78, was almost identical with what it was during the two preceding years; the admissions into hospital were only 673 during 1881, against 1,030 in 1880. The details of the admissions and deaths do not call for any special remarks, except that there were 12 admissions, with 4 deaths from cholera, and 56 admissions from Guinea-worm, during the year, half of which occurred during March, April, and May. There were six cases of small-pox, but no deaths.

Madras army.

Of the regular troops in the three Presidencies during 1881, the army of Madras furnished, as a whole, the most favourable results. The admission-rate was 997 per 1,000, the daily sick-rate 41, and the mortality amongst men present with their regiments 12·02, or including absent deaths, 16·75. As compared with the statistics of 1880, there was an improvement under each of the above headings, the admission-rate was about 400 per 1,000, the sick-rate 13 per 1,000, and the total mortality above 3 per 1,000 lower than in that year. The exact figures are given in the accompanying statement, as also those for all the preceding years, which have been prepared in this office:—

Year.	Average Strength.	Ratio per 1,000.				Mortality, including absent Deaths.
		Admissions into Hospital.	Daily sick.	Deaths from		
				Cholera.	All causes.	
1877 - -	28,804	861	28	2·79	11·80	14·36
1878 - -	28,728	841	29	2·23	12·25	15·49
1879 - -	27,314	1,269	43	3·19	18·89	21·23
1880 - -	28,710	1,399	54	0·10	15·57	19·54
1881 - -	28,533	997	41	1·37	12·02	16·75

Nearly one-half of the admissions of the year amongst the troops of the Madras Presidency was due to fevers. In this statement fevers of all kinds are included, though, as regards enteric fever, it should be noted that only one case was recorded, and that this case proved fatal. There were 76 admissions from cholera against 4 in the preceding year, and 49 from small-pox against 26 in 1880. Of the 343 deaths which occurred amongst these troops, 51 were due to fevers, 42 to bowel complaints, 33 to atrophy and anæmia, and 45 to respiratory diseases; so that about one-half the total mortality is attributable to these causes. There were 39 deaths from cholera, 11 of which occurred in August and 16 in December. There were only four deaths from small-pox, all in the first half of the year, and, as already observed, only one death from enteric fever. With the exception of cholera, there has been a decreased mortality under nearly every heading. To dropsy 29 deaths were attributed, against 24 during

1880; but of the 29, twenty were due to beri-beri. This latter disease appears to have prevailed more or less generally throughout the year.

Of the larger stations of this Presidency, Bellary returned the highest admission-rate, 1,792 per 1,000. In the other stations the admission-rate was comparatively low. Amongst the Madras troops at Banda the admission-rate was 1,820 per 1,000; and in Burma also, the admissions at two stations were high—at Rangoon 1,569, and at Shoaygheen 1,729. In the large cantonment of Bangalore the admissions were only 563 per 1,000, and at Mangalore only 391. Of the 76 cases of cholera which occurred amongst the troops of the Presidency, 24 took place at Kamptee, 16 having been during the month of August, and 39 at Trichinopoly, during November and December. The admission-rate amongst the troops at the Andamans fell from 2,118 in 1880 to 1,417 in 1881. Five of the larger stations, in which troops of this Presidency were located, returned death-rates exceeding 20 per 1,000, Rangoon, 32·66, which was almost identical with the ratio for 1880; Vizianagram, 23·65; Kamptee, 21·82; Trichinopoly, 21·65; Vizagapatam, 20·93. With the exception of Kamptee and Trichinopoly, the chief causes of mortality corresponded very closely with the chief causes of admission as above mentioned; but at Kamptee, out of a total of 25 deaths, amongst men present with the regiment, 14 were due to cholera; and at Trichinopoly, out of a total of 40 deaths, 18 were from this disease.

Bombay army.

Out of an average strength of 24,945 men, composing the native army of Bombay, over one-fourth was on service in Southern Afghanistan during the year under report. As regards the troops which were in cantonments, the results for 1881, though favourable, were not so much so as were those of Madras, when compared with 1880. Although the admissions fell from 1,283 in 1880 to 1,166 in 1881, and the daily sick from 45 to 41, the mortality amongst men present with their regiments rose from 10·44 to 14·01. When absent deaths are included, the ratio for 1881, 25·93 per 1,000, is less than half what it was in 1880. It must, however, be borne in mind that, as both these death-rates are calculated on the total strength, they include the troops in Afghanistan, and consequently the mortality of 1880 includes also the 690 men who fell at Maiwand and Deh Khoja. Taking the figures of the last five years, it may be stated, generally, that those referring to the sanitary history of the troops in the cantonments of Bombay during 1881 occupy an average position, as may be seen by a glance at the following comparative statement:—

Year.	Average Strength.	Ratio per 1,000.				Mortality, including absent deaths.
		Admissions into Hospital.	Daily Sick.	Deaths from		
				Cholera.	All Causes.	
1877	29,388	1,074	33	1·93	10·90	12·96
1878	23,672	1,702	45	2·36	15·12	17·95
1879	22,854	1,663	51	3·11	20·22	24·90
1880*	15,328	1,283	45	—	10·44	56·53†
1881*	18,349	1,166	41	1·85	14·01	25·93†

* Excluding Afghanistan. † These ratios are calculated on the total regimental strength, including the army in Afghanistan.

Nearly one-half the admissions into hospital amongst troops in cantonments were due to intermittent fever. There were 50 admissions from cholera, 14 from small-pox, and 4 from enteric fever, but no deaths from either of the two latter diseases. There were 251 admissions from guinea-worm, 153 of which occurred in March, April, May and June—these months being, speaking generally, the months of greatest prevalence in the Madras Presidency also. Of the 257 deaths amongst men present with their regiments in cantonments, 61 were ascribed to diseases of the respiratory organs, 47 to fevers, and 25 to bowel complaints. More than half the total mortality was returned under these three headings. There were 34 deaths from cholera.

Of the larger cantonments in the Bombay Presidency, Mehidpur and Admedabad returned the highest admission-rates, 1,901 and 1,644 per 1,000, respectively, considerably more than half the ratio in both instances being due to fevers. The troops stationed in the Persian Gulf were extremely sickly, the admission-rate having been 2,457 per 1,000. The chief causes of admissions, besides fevers, were diseases of respiratory organs, rheumatism, and bowel complaints. The average strength, however, was small,

only 153. There were 22 cases of cholera at Surat in May, and 12 in Bombay during June, July and August. The admission-rate at Aden was 887 per 1,000, only 168 of which were due to fevers; the death rate was 13·31. Judged by the death-rate, Surat was the most unhealthy station in the Presidency, having returned a mortality ratio of 40·76. Of this ratio, however, 19·02 was due to cholera. The only other stations which returned a ratio exceeding 20 per 1,000 were Karachi, 24·56, and Ahmedadad, 20·54. Out of a total of 22 deaths at the latter station, five were from cholera. The mortality amongst the troops in Upper Sind was also high, 23·85; there were in all 31 deaths, 23 of which were due to fevers, respiratory diseases, and bowel complaints.

As already observed, over one-fourth of the Native Army of Bombay was in Southern Afghanistan during the whole of 1881. As compared with the troops in cantonments, the returns from Afghanistan are, under each of the general headings, more unfavourable. The daily sick was 76 per 1,000, as compared with 41 in cantonments; the admissions 2,317, as compared with 1,166; and the mortality 57·76, as compared with 14·01. There were no cases of cholera among this part of the army, and only seven cases of small-pox, of whom two died. Two cases and one death are ascribed to enteric fever. Of the 381 deaths amongst these troops in Southern Afghanistan, 218 were due to diseases of the respiratory organs, the greater part of which occurred during the first four and last two months of the year, nearly one-third of the total having occurred in January alone. The ratio of admissions from these causes was 301·2 per 1,000, as compared with 65·9 in cantonments. It was observed, with regard to the Bengal troops in Afghanistan, that no cases of guinea-worm had been registered as having occurred amongst them. Amongst the Bombay troops, however, there were 14 admissions due to this cause, so that it is probable that the parasite was acquired in Bombay previous to the departure of the men for Afghanistan.

Comparison of the three Presidencies.

In the following statement the principal statistics of all branches of the Native Army in the three Presidencies have been brought together for convenience of comparison, and, so far as practicable, the figures dealing with the troops stationed in cantonments have been kept apart from those of the troops on service in Southern Afghanistan. As in former years, the first column includes both the deaths which occurred amongst the men present with, and absent from, their regiments, and the ratios have been calculated on the aggregate regimental strength. The second column gives the strength of the men present with their regiments, and on these figures the ratios in the subsequent columns have been calculated.

Presidency.	Total Deaths per 1,000, including Absentees.	Average Strength present with Regiments.	Ratio per 1,000 of Strength.			
			Admissions into Hospital.	Daily Sick.	Deaths from Cholera.	Deaths from all Causes.
Bengal Native Army - -	27·73	38,721	1,494	52	0·88	23·84
" " (excluding Southern Afghanistan)	—	36,896	1,495	51	0·92	19·76
Madras " - - -	16·75	28,533	997	41	1·37	12·02
Bombay " - - -	25·93	24,945	1,471	50	1·36	25·58
" " (excluding Southern Afghanistan)	—	18,349	1,166	41	1·85	14·01
Central India Regiments - -	13·34	5,039	815	26	—	12·11
Punjab Frontier Field Force -	22·64	10,307	1,718	55	—	17·95
Hyderabad Contingent - -	8·52	7,068	673	24	0·57	7·78
India - - - -	22·62	114,612	1,305	46	0·97	19·24

In last annual report a summary of the several regimental sanitary sheets of the Native troops of each Presidency was given. A similar abstract has been prepared for the year under review, to which reference should be made with regard to the chief causes to which medical officers have attributed any exceptional sickness and mortality in the regiments.

Jails.

Sickness and mortality in jails.

The year under report is the fifth year for which the statistics of the jails of the three Presidencies have been prepared on a uniform plan by the Statistical Branch of this office. The first three years of this period were characterised by excessive sickness and mortality, not only amongst the prisoners, but also amongst the general population of the country. In 1877, as one of the consequences of the famine which prevailed in

Madras and Bombay, the prison population was augmented to a very great extent, and the sick and death-rates were greatly increased. The effects of this famine continued to be felt in 1879 also in these two Presidencies; moreover, during this year a large portion of the Bengal Presidency experienced severe privation and want, so that as a whole the statistical returns of the jails during 1878 were even worse than were those of 1877. The results of 1879, though better than those of the preceding year, were still extremely unfavourable, and it was not till 1880 that a marked improvement was observed—an improvement which gave rise to the hope that a return was gradually taking place to the condition of ordinary years. The main features of the sanitary statistics of Indian jails for these four years are brought together in the subjoined tabular statement, and compared with those for the year under report:—

Year.	Average Strength.	Ratio per 1,000.				
		Admission into Hospital.	Daily Sick.	Deaths from		
				Cholera.	Dysentery and Diarrhœa.	All causes.
1872–76	99,758	1,016	?	2·86	13·48	36·24
1877	110,147	1,019	36	7·31	25·80	61·95
1878	127,914	1,198	46	5·90	32·76	91·31
1879	127,680	1,294	49	4·44	27·66	73·73
1880	106,763	1,213	46	0·74	19·43	48·31
1881	100,844	1,214	45	3·03	16·92	44·03

As will be seen from the above figures, the average jail population of India fell from 106,763 in 1880 to 100,844 in 1881. As compared with 1879, the decrease was nearly 17,000, and a decrease of over 27,000 as compared with 1878. It has not been found practicable to give statistics for the whole of India for the years preceding the last quinquennium, which can be properly compared with those prepared in this office from 1877 and onwards; but the figures in the first line of the foregoing statement, giving the mean results of the years 1872–76 (which have been compiled from the several local reports), will suffice to show the general character of the returns during the five years preceding the famine of 1877. The average number of prisoners in British India during the year under report was but little above the mean number of the five years preceding the famine, so that the number for 1881 may be looked upon as something approaching to a fairly normal average for this country. This would imply that, supposing the estimated population of the area comprised in these prison statistics to be about 202,000,000,* and the number of convicted persons to be 100,000, the proportion of prisoners in India to the general population would be about one in every 2,000.

With regard to the sickness and mortality amongst prisoners during 1881, as compared with the preceding year, a reference to the above tabular statement will show that the admission and daily sick-rates were almost identical during both years, 1,214 and 45 per 1,000, as compared with 1,213 and 46 during 1880. The death-rate, however, fell from 48·31 to 44·03 per 1,000. In 1879 the mortality was 73·73, and in 1878 it attained the very high ratio of 91·31, or nearly double the ratio of the year under review. Both the admissions and the mortality, however, are still higher than they were during any of the five years preceding 1877, the highest admission-rate during that period having been 1,056 per 1,000 in 1874, and the highest death-rate 38·54 in 1873. As compared with 1880, the death-rate from cholera during 1881, 3·03 per 1,000, was high, but not as compared with most of the nine preceding years, which are dealt with in the foregoing tabular statement.

Although, as stated in a previous paragraph, the jail population of India, taken as a whole, has greatly decreased in 1881, as compared with that of the preceding four years, nevertheless the decrease in the several Presidencies is far from uniform. This will become evident on examination of the following statistics, in which the strength of the year under report is compared with that of 1878, when the prison population was at its maximum, and with the mean of the five years, 1872–76, preceding the famine:—

* The actual population of India, as ascertained when the census of 1881 was taken, is 218,559,918, but the population of the area over which the jail statistics have been collected, as given in this report, is 202,097,700.

Ratio of Prisoners, per 10,000 of Populaton, in each of the Three Presidencies, for 1881, 1878, and 1872–76, compared.

Presidency.	Period.	General Population.*	Prisoners.		
			Average Number.	Proportion to 10,000 of Population.	Deaths per 1,000 of average Strength.
Bengal	1872–76	148,406,462	68,328	4·6	39·03
	1878	—	78,126	5·3	65·85
	1881	—	63,478	4·3	44·42
Madras	1872–76	30,839,181	9,607	3·1	32·37
	1878	—	21,315	6·9	125·92
	1881	—	10,332	3·3	41·91
Bombay	1872–76	16,383,422	8,011	4·9	26·61
	1878	—	13,139	8·0	118·27
	1881	—	9,910	6·0	41·88

* Census of 1881. See Supplement to the *Gazette of India*, September 10th, 1881, page 1081.

The above table shows that the ratio of prisoners to the general population in the Bengal Presidency has decreased from 5·3 in 1878 to 4·3 per 10,000 in 1881; that of Madras from 6·9 to 3·3; and that of Bombay from 8·0 to 6·0. Further, the ratios for Bengal and Madras during 1881 were nearly identical with the mean of the five years preceding the famine; but the Bombay ratio for 1881 is still nearly one-fourth higher than the mean for that period.

As regards the comparative rates of sickness and mortality in the several Presidencies during 1881, the Madras returns are, on the whole the most favourable, Bombay stands next, and Bengal stands third, although, as regards the mortality especially, no great difference is to be noted. In Madras and Bombay the death-rate is almost identical, as will be seen from the subjoined comparative table :—

Presidency.	Average Strength.	Ratio per 1,000.				
		Admissions into Hospital.	Daily sick.	Deaths from		
				Cholera.	Dysentery and Diarrhœa.	All causes.
Bengal	63,478	1,151	41	3·10	17·91	44·42
Madras	10,332	737	28	3·19	20·62	41·91
Bombay	9,910	1,076	34	3·73	12·01	41·88

With the exception of Bengal Proper, the prison population of each of the several provinces in the Bengal Presidency was, during the last quinquennium, at its highest in 1878. In Bengal Proper, however, the numbers for 1879 were slightly above those for 1878, but in the following statement, showing the ratios of prison strength to the general population during recent years, the figures for 1878 have been taken throughout as representing the maximum of the five-year period, 1877–81. The prison population of the several provinces during the year under report has varied from 2·3 per 10,000 in Bengal to 7·5 in the Punjab. In the North-Western Provinces and Oudh the ratio was 6·2, and in the Central Provinces 3·5. As compared with 1878, the greatest decrease during 1881 has taken place in the North-Western Provinces and Oudh, and there is some decrease in each of the other provinces, with the exception only of Assam, in which there is some increase. In this last province, as also in the Central Provinces, the number of prisoners during 1881 is higher than it was in the five-year period preceding 1877; and slightly so, likewise, in the Punjab. The jail strength of the Presidency, as

a whole, however, was lower during 1881 than the average of the five years preceding the famine in Madras and Bombay.

Ratio of Prisoners per 1,000 of Population in each Province of Bengal, also in Berar and in British Burma, for 1881, 1878, and 1872–76 compared.

Province.	Period.	General Population.	Prisoners. Average Number.	Prisoners. Proportion to 10,000 of Population.	Prisoners. Deaths per 1,000 of Average Strength.
Bengal Proper	1872–76	68,829,920	19,082	2·8	53·88
	1878		17,718	2·6	70·89
	1881		16,014	2·3	65·01
Assam	1872–76	4,815,157	1,015	2·1	51·03
	1878		1,188	2·4	60·61
	1881		1,307	2·7	39·02
N.-W. Provinces and Oudh	1872–76	44,107,034	28,345	6·4	31·89
	1878		28,528	6·7	41·3
	1881		27,589	6·2	23·78
Punjab	1872–76	18,786,107	13,964	7·4	36·67
	1878		15,230	8·1	109·72
	1881		14,075	7·5	65·15
Central Provinces	1872–76	11,505,149	3,323	2·9	36·78
	1878		4,445	3·9	118·11
	1881		4,032	3·5	29·30
Berar	1872–76	2,670,982	966	3·6	33·34
	1878		1,025	3·8	75·12
	1881		1,272	4·8	16·51
British Burma	1872–76	3,703,646	4,682	12·6	31·82
	1878		4,748	12·8	57·71
	1881		4,627	12·5	45·82

The daily sick and admission-rates of the Presidency are slightly higher than they were in 1880 but much lower than they were during 1879, as will be evident from the table in the margin; the death-rate has fallen from 77·90 in 1879 and 51·12 in 1880 to 44·42 during 1881. The mortality of the year is, moreover, considerably lower than the annual average of the preceding 22 years, 1859 to 1880, viz., 55·0 per 1,000. It will be seen that the returns for 1877 in this Presidency were exceptionally favourable, and that the average strength of the aggregate of the jails was almost identical with what it was in the year under report.

Jails of the Bengal Presidency.

Year.	Average Strength.	Ratio per 1000. Admissions.	Daily Sick.	Deaths from Cholera.	Deaths from Dysentery and Diarrhœa.	Deaths from All causes.
1877	63,000	967	30	3·07	10·89	31·88
1878	78,116	1,151	40	5·34	28·27	65·85
1879	75,801	1,255	46	6·33	30·45	77·90
1880	66,751	1,107	40	1·09	21·51	51·12
1881	63,478	1,151	41	3·70	17·91	44·42

As usual, fevers stand first as causes of admissions into hospital in the Bengal Presidency, having contributed not far from one half of the whole. The relative positions in which some of the more ordinary diseases stood as causes of admissions into hospital amongst prisoners, are shown in the accompanying statement, which will also serve to illustrate how little change takes place in their position on the list from year to year. As compared with 1880, the ten causes cited occupy precisely the same position; and, with the exception of the admissions from fevers, which show a considerably increased ratio, the proportion which each contributed to the general admission-rate has undergone but little change:—

Statement showing the Chief Diseases which have caused Admissions into Hospital in the Jails of the Bengal Presidency from 1873 to 1881.

Number.	Diseases.	Admitted per 1,000 of Average Strength.								
		1881.	1880.	1879.	1878.	1877.	1876.	1875.	1874.	1873.
1	Fevers	528	458	659	556	370	457	398	445	450
2	Abscess and ulcers	127	133	114	113	122	115	99	106	110
3	Diarrhœa	106	117	112	107	94	86	90	96	107
4	Dysentery	105	116	129	186	97	104	95	101	102
5	Respiratory diseases	48	48	41	44	43	41	37	45	44
6	Wounds and accidents	40	37	35	43	48	38	42	44	42
7	Atrophy and anæmia	28	28	29	27	23	19	16	14	19
8	Venereal diseases	20	20	18	18	14	11	20	15	13
9	Rheumatism	15	15	14	15	20	17	16	19	16
10	Eye diseases	13	14	11	12	12	11	11	12	13
	Total of the 10	1,030	986	1,162	1,071	847	899	824	897	923
	Total from all causes	1,151	1,108	1,285	1,181	967	1,017	942	1,027	1,042

As causes of mortality bowel complaints occupied the first place, with 17·91 per 1,000 out of a total ratio from all causes of 44·42. This ratio is lower than any recorded since 1877, but is still higher than in any of the other four preceding years cited in the following tabular statement. The mortality from fevers was slightly increased, and the cholera ratio rose from 1·00 to 3·10 per 1,000. Under all the other headings diminished ratios were recorded, and the proportion of the mortality caused by the 10 causes cited fell from 45·66 to 40·13.

Statement showing the Diseases which have been the Chief Causes of the Mortality amongst Prisoners of the Bengal Presidency from 1873 to 1881.

Number.	Diseases.	Died per 1,000 of Average Strength.								
		1881.	1880.	1879.	1878.	1877.	1876.	1875.	1874.	1873.
1	Dysentery and diarrhœa	17·91	21·51	30·65	28·27	10·59	14·75	12·38	16·38	16·63
2	Respiratory diseases	7·62	9·38	9·53	8·82	5·41	5·45	5·01	6·02	7·00
3	Fevers	4·65	4·45	13·82	7·40	1·97	2·36	4·20	3·72	5·47
4	Cholera	3·10	1·00	6·38	5·34	3·07	4·24	2·35	2·48	2·97
5	Atrophy and anæmia	2·58	3·66	5·43	5·01	2·69	2·19	1·65	2·32	1·94
6	Phthisis pulmonalis	2·24	2·55	3·60	2·76	2·36	3·24	1·86	2·51	2·33
7	Dropsy	·68	1·05	0·99	0·83	0·71	0·73	0·67	0·85	0·55
8	Apoplexy	·58	·88	0·76	1·02	0·80	0·59	0·52	0·31	0·81
9	Wounds and accidents	·55	·63	0·66	0·95	0·75	0·52	0·62	0·69	0·73
10	Spleen disease	·22	·57	0·31	0·23	0·20	0·29	0·77	0·37	0·33
	Total of the ten	40·13	45·66	71·53	60·63	28·55	34·36	30·03	35·70	38·76
	Total from all causes	44·42	51·12	77·90	65·85	31·88	37·51	33·65	39·90	43·08

For the more convenient study of the distribution of disease in this large Presidency, the jails have been arranged into groups in accordance with their geographical positions. The jails of the provinces of Lower Bengal and Assam constitute the first group; those in Chota-Nagpore and in the districts of Dinapore, Benares, and Oudh, the Gangetic Provinces and Oudh group, the second; the third is composed of the jails in the Central Provinces (excluding Jubbulpore and Saugor); the fourth of those in the Agra district and in Central India; the fifth in the Rohilkund and Meerut districts; and the sixth group includes all the jails in the Punjab. The leading facts for 1881 are summarised in the accompanying statement, in which, also, are incorporated similar data as regards the preceding four years:—

Statement showing Sickness and Mortality amongst the Prisoners of the Bengal Presidency (arranged into Groups in accordance with their Geographical Positions) from 1877 to 1881.

Groups.		Average Strength.	Ratio per 1,000.				
			Admissions into Hospital.	Daily Sick.	Deaths from		
					Cholera.	Dysentery and Diarrhœa.	All causes.
I.—Lower Bengal and Assam	1877	14,934	1,391	41	7·97	17·88	49·28
	1878	14,994	1,390	46	6·07	30·01	63·63
	1879	15,351	1,599	52	15·33	44·75	94·46
	1880	14,848	1,635	54	1·89	31·59	63·91
	1881	13,814	1,583	54	4·92	33·74	65·30
II.—Gangetic Provinces and Oudh	1877	21,593	578	20	3·43	8·20	22·74
	1878	27,239	595	21	5·29	14·35	37·59
	1879	24,270	865	29	4·41	17·96	41·78
	1880	20,876	666	26	0·48	15·14	31·95
	1881	19,867	736	29	1·51	13·62	29·90
III.—Central Provinces (excluding Jubbulpore and Saugor).	1877	2,348	943	34	—	13·20	35·77
	1878	3,053	1,266	47	32·75	42·25	132·98
	1879	3,493	866	35	15·74	29·77	77·58
	1880	3,339	970	38	4·79	27·85	59·96
	1881	2,779	863	29	—	12·59	31·67
IV.—Agra and Central India	1877	4,779	728	34	0·21	4·18	30·13
	1878	6,396	1,204	54	19·32	28·61	76·89
	1879	5,645	1,282	59	—	24·44	67·49
	1880	4,991	1,000	47	1·80	16·68	46·08
	1881	4,577	1,016	48	0·21	6·96	26·04
V.—Rohilkund and Meerut	1877	7,818	560	20	—	6·46	29·85
	1878	11,204	918	37	0·89	25·97	53·64
	1879	9,901	1,288	58	0·30	23·33	51·71
	1880	8,373	869	42	0·36	9·32	28·31
	1881	8,066	851	38	—	5·46	23·80
VI.—Punjab	1877	12,129	1,504	37	0·08	10·64	33·80
	1878	15,230	2,192	66	0·39	59·17	109·72
	1879	15,141	1,735	57	4·16	43·99	149·68
	1880	14,324	1,352	42	0·07	27·71	78·82
	1881	14,075	1,519	48	6·96	20·39	65·15

In three of the above groups, Nos. II., III., and V., the admissions into hospital were below 900 per 1,000, and the highest death-rate from all causes was 31·67. The most unfavourable results were furnished by the Lower Bengal and Assam group of jails, with an admission-rate of 1,583 and a death-rate of 65·30, showing a somewhat increased mortality over the high ratio of 1880. All the other groups show improvement as regards the death-rate, and, in some instances, to a very marked extent. The lowest death-rate was registered amongst the jails of the Rohilkund and Meerut group, 23·80 per 1,000, and the next lowest, 26·04, in the Agra and Central India group. Although in the Presidency, taken as a whole, the prevalence of cholera was more marked than during 1880, its distribution, as inferred from the jail statistics, was more general; seeing that, whereas in 1880 it was not absent from any of the groups, two of the groups—Central Provinces and Rohilkund and Meerut—have furnished blank returns under this heading during 1881. The highest death-rate from cholera was returned by the Punjab group, 6·96 against 0·07 in 1880, and the next highest by the Lower Bengal and Assam group of jails, 4·92 against 1·89 during the previous year.

As is very generally the case, the statistics of the Oudh jails, if taken apart from the North-Western Provinces with which it is now incorporated, are the most favourable, the admissions equalled only 514 per 1,000, the daily sick 18, and the total mortality, 15·00. On the other hand, those of Lower Bengal, as is likewise very generally the case, furnish on the whole the most unfavourable—the admission and daily sick-rates being about three times higher than those of Oudh, and the death-rate more than four times higher. The precise figures will be found in the subjoined statement, where the admissions, daily sick, and death-rates of the seven provinces in the Presidency, together with the ratios for British Burma and for the convict settlement at the Andamans, are given for the last five years. The figures for the several provinces have been thus brought together for

convenience of comparison, but they will be dealt with separately when the results in each province come to be considered.

Per 1,000 of Average Strength.	Years.	Bengal.	Assam.	Oudh.	North-Western Provinces.	Central Provinces.	Punjab.	Berar.	British Burma.	Andaman Islands.
Admissions	1877	1,283	1,382	504	585	907	1,504	937	844	1,687
	1878	1,290	1,629	457	892	1,148	2,192	1,283	897	1,867
	1879	1,573	1,436	743	1,064	859	1,735	951	659	2,346
	1880	1,542	1,173	522	900	973	1,352	942	870	2,492
	1881	1,572	1,305	514	845	790	1,519	825	883	2,308
Daily sick	1877	39	40	16	21	37	37	26	38	76
	1878	42	51	17	32	47	66	43	41	88
	1879	51	46	24	44	35	57	26	28	92
	1880	52	42	18	35	39	42	33	30	112
	1881	52	42	18	38	29	48	24	36	99
Deaths	1877	50·10	56·30	10·56	19·71	45·06	33·80	15·58	56·76	34·30
	1878	70·89	60·61	23·55	46·52	118·11	109·72	75·12	57·71	69·79
	1879	97·57	85·80	19·66	48·45	67·76	140·08	27·30	32·20	47·54
	1880	63·82	52·46	18·19	31·44	60·13	78·82	35·64	24·89	49·65
	1881	65·01	39·02	15·00	26·61	29·30	65·15	16·51	45·82	48·02

The improved character of the statistics of the jails of Lower Bengal during 1880, as compared with those of 1878 and 1879, gave rise to the hope, expressed in last year's annual report, that the general causes which had so unfavourably influenced the vital statistics of this province since 1876 were passing away. The experience of another year, however, has shown that this hope has been but partially realised, and that indeed the statistics of 1881 are somewhat less favourable than those of 1880. The admission-rate has slightly increased from 1,542 to 1,572 per 1,000; the daily sick, 52, is the same, and the death-rate has increased from 63·82 to 65·01. With reference to the higher death-rate, it is to be borne in mind that the mortality from cholera during 1881, 5·54, was 4 per 1,000 higher than it was in 1880, though about 13 per 1,000 lower than the ratio for 1879. Cholera was, thus, far from being exceptionally prevalent; indeed the cholera mortality of the year under report was, with the exception only of the years 1875 and 1880, the lowest recorded since 1871. But what calls for attention, perhaps, more prominently than the continued high death-rate in these provinces, is the persistent increase which is to be noted almost year by year in the admission and daily sick-rates. This feature will be observed from a glance at the statement given in the margin, the ratios of sickness for 1881 being, on the whole, higher than in any of the four years included in the table: they are, in fact, higher than those of any of the ten years preceding the year under report.

Year.	Average Strength.	Ratio per 1,000. Admissions.	Daily sick.	Deaths from Cholera.	Deaths from Dysentery and Diarrhœa.	Deaths from All causes.
1877*	17,170	1,354	40	8·3	17·0	50·6
1878	17,718	1,891	43	11·85	31·60	70·89
1879	17,771	1,573	51	18·91	45·32	97·57
1880	17,319	1,542	52	1·02	33·02	63·82
1881	16,014	1,572	52	5·54	33·48	65·01

* From the local report.

The local authorities attributed the extremely unfavourable statistics of 1879 to the general adoption of the scale of diet recommended by the Indian Jail Conference of 1877, and which was in force between March 1879 and April 1880. This matter was carefully examined in this Office Annual Report for 1879, and again, and very fully, in that for 1880, and the conclusion expressed in both reports, that the unsatisfactory condition of the Bengal jails was due to other causes than that of insufficient and unsuitable food, is fully borne out by the experience of another year. The question is, beyond all doubt, a very complex one, and the strenuous efforts which are being made by the local authorities to deal with it will, it is earnestly hoped, be crowned with success.

With regard to the chief causes to which the sickness and mortality have been ascribed, fevers and bowel complaints combined, constituted 1,069 out of a total ratio from all causes of 1,572 per 1,000 of the admissions; that is to say, over two-thirds, and 37·64, or more than half of the death-rate. The ratios for the preceding five years seem to indicate that the sickness and mortality have, in the main, been due to like causes.

As has already been remarked, the Punjab stands next to Bengal as regards the unfavourable character of its returns, though, as compared with each of the three preceding years, the results for 1881 in respect of diminished mortality are very satisfactory. The death-rate has fallen to 65·15 per 1,000 from 78·82 in 1880, and 140·08

in 1879. It is, nevertheless, evident that sickness is still very prevalent in the jails of this province, seeing that the admissions during 1881 were equal to 1,519 and the daily sick to 48 per 1,000—higher ratios, under both heads, than those for 1880. It may also be noted that the average jail population of the Province has not undergone any marked diminution; the number of the prisoners during 1881, was equal to 7·5 per 10,000 of the general population.

In last year's annual report attention was drawn to the extremely high death-rates in three of the jails of the Province,—Rupar 104·17 per 1,000, Lahore 101·49, and Rawalpindi 391·75,—and it was observed that, judging from the history of these jails so far as could be ascertained, it would seem impossible to avoid the conclusion that the high death-rate was, at all events to some extent, attributable to agencies at work within the precints of the jails. As regards the Rupar jail, it was pointed out that the very unfavourable results may have been largely due to the prisoners having been employed in extensive canal excavation works. It is highly satisfactory to have to record that the death-rate at Rupar has fallen to 55·74 per 1,000, or nearly one-half the ratio of the preceding year, and that, as compared with the mortality during 1879, it was less than one-fifth. The results in the other two jails, however, were still very unfavourable, the death-rate in the Lahore central jail having been 157·33 per 1,000, and in the Rawalpindi jail 195·33. As regards the Lahore jail, 46·84 per 1,000 of the total mortality was due to cholera—this disease having been prevalent in the neighbourhood during the year. There was no cholera at Rawalpindi; nevertheless a death-rate of nearly 20 per cent. of the strength was recorded which, though a great improvement on the ratios for the previous two years, still evinces a most unsatisfactory condition. In 1878 the total death-rate at this jail was only 26·35. The causes of the excessive sickness and mortality in this jail, which commenced in October 1876 and continued till April 1881, have recently formed the subject of special correspondence. Whatever may have been the exact nature of the fever which proved so fatal—and on this point there is decided difference of opinion—there can be no question that removal from the jail was imperatively called for, and the beneficial results which followed this movement when it was at last carried out convey an important practical lesson which cannot be too strongly impressed on all jail authorities in India.

In marked contrast to the results in Lower Bengal and the Punjab, the highly satisfactory character of the returns of the North-Western Provinces and Oudh jails may be cited. The daily sick-rate of the combined provinces was only 32 per 1,000, the admission-rate 764, and the death-rate 23·78—the lowest mortality recorded by any of the larger provinces of India. With the exception of 1879, the admission and daily sick-rates have been very low during the last five years, and the most favourable returns of the series under all headings were those of 1877.

The statistics of the jails of the Central Provinces do not call for any special remark, except that like those of the North-Western Provinces and Oudh they were favourable. The death-rate, 29·30 per 1,000, was less than half what it was in 1880, and lower than it had been for several years past. The admission and daily sick-rates, also, were the lowest of the last five years, and there was not a single case of cholera in any of the jails during the whole of 1881.

The sanitary history of the jails of Berar during 1881 is likewise very satisfactory. The rates of admissions into hospital and of daily sick were low, and the mortality 16·51, was less than half what it was in the previous year. The death-rate from bowel complaints was high during 1880—13·82 against 2·36 in 1881. As, however, the aggregate average strength of the six jails in the province is but little over 1,200, considerable fluctuation in the ratios is to be expected.

During 1880 the statistics of British Burma were, on the whole, the most satisfactory of any Indian province; the death-rate was only 24·89, and the admission and daily sick-rates 871 and 30 per 1,000. Statistics show that whereas during 1881 there was but little increase in the admissions, the mortality, 45·82, had nearly doubled; out of a total of 212 deaths which occurred in the jails of the province, considerably more than one-half was returned from two jails—67 at Thayetmyo and 64 at Moulmein. Of the deaths at Moulmein, 27 were due to cholera; and of these at Thayetmyo, 50 were due to an epidemic of beri-beri, which prevailed from July to October. In all there were 38 deaths from cholera; and were these, together with the deaths from beri-beri, excluded from the statistics, the death-rate for the province would be only 26·8, or only 2 per 1,000 higher than the low ratio of 1880.

Mr. Bernard, the Chief Commissioner, in his resolution on jail administration during the year, thus sums up the information which had been collected concerning the outbreak of beri-beri: "Efforts to check the ravages of the disease failed until the

" month of October, when a large number of prisoners were released and the remainder " were transferred to Moulmein. This measure proved completely successful; not a single " fresh case appeared, and not a single death occurred among the prisoners transferred. " The etiology of the disease is at present but little understood. It was, however, proved " before the Medical Committee, which was convened by the Chief Commissioner to " inquire into the circumstances of the outbreak at Thayetmyo, that, during part of " the year, the quality of the prisoners' rations was not so good as it should have been; " that the clothing had been insufficient, and that the water from the jail wells " contained an undue proportion of lime and magnesia. The Inspector-General is of " opinion that these circumstances affected the health of the prisoners and predisposed " their constitutions to receive the poison which produces beri-beri. Mr. Kelly is of " opinion that this poison is conveyed in the exhalations of the soil, and accordingly, " under his advice, orders have been issued that all wards and verandahs of the jail " should be asphalted. It has been ascertained that a part of the ground occupied by " the jail was formerly a burial-ground. Whether this circumstance conduced in any " way to the outbreak it is impossible to say, but all soil impregnated with, or " consisting of, organic matter is being removed and replaced by good, pure soil from " outside. The water for the prisoners is now being obtained from the river, and due " attention is being paid to the food and clothing of the prisoners. Two facts in " connexion with beri-beri may be held to have been established—(1) that a complete " change of air forms the only known method of checking the disease; and (2) that the " disease is not contagious."

The returns of the Assam jails, like those of the Punjab, show a comparatively low death-rate, 39·02, as compared with the high admission and sick-rates, 1,305 and 42 per 1,000 respectively. There was an increase in the admissions, and a decrease of over 13 per 1,000 in the deaths, notwithstanding that the mortality from cholera was 7·65 as compared with 0·79 during 1880. There is nothing in the sanitary history of the year in this province which calls for special remark.

The average strength of the jails of the Madras Presidency during the year under report, 10,332 prisoners, was less than half what it was in 1878, and some 1,300 less than it was in 1880. Since the famine of 1877, when the mortality in the jails rose to 176·01 per 1,000, there has been a gradual improvement, until in 1881, the mortality, 44·91, is slightly lower than it was in the year preceding the famine. It is, however, still nearly 10 per 1,000 higher than the mean of the five-year period preceding 1877. The admission and daily sick-rates were comparatively low, and somewhat lower than those of 1880.

The death-rate from cholera in the Presidency, 3·19, during 1881 was high as compared with the preceding year, owing chiefly to an outbreak of the disease which took place in November and December in the Trichinopoly central jail. All the deaths from cholera returned as having occurred amongst the prisoners of this Presidency, a total of 33, took place at Trichinopoly, 32 in the central and one in the district jail. Of the 125 deaths which occurred in the Trichinopoly central jail, 112 were due to cholera, dysentery, and diarrhœa; and it was to deaths from these causes that the deplorably high mortality of the year at this large jail, 121·36, is chiefly due. Judging from the reports which have been received in this office regarding this outbreak, it would appear that the local authorities were not sufficiently alive to the importance of early movement into camp. It appears that the first case occurred on the 14th November; but no movement was made till the 20th November, when 20 cases had occurred, and then it was only a partial movement to the jail garden: the jail was not vacated until the 8th December, when 84 cases of the disease had been admitted into hospital. The localised character of cholera, and the consequent necessity for early movement, are facts which ought never to be lost sight of in dealing with this disease.

During the last two years the rates of mortality in the jails of the Bombay Presidency have been almost identical with those of the Madras Presidency, though the admission and daily sick-rates have, on the whole, been considerably higher. During the year under review, the admissions were 1,076, and the daily sick, 34 per 1,000. The mortality equalled 41·38, against 45·16 in 1880. The mortality of the last two years was considerably less than half what it was during 1878 and 1879, and there was a decrease in the average strength during 1881 of nearly 25 per cent. as compared with 1878. During 1880 there was a marked exemption from cholera in the jails of this, as of other Presidencies. There were only 5 deaths from the disease against 37 in 1881. Of these, 18, or nearly one-half, took place in the Surat jail between the months of May and August. The occurrence of this outbreak raised the mortality in this jail to 138·76, the highest ratio of any jail in the Presidency. Excluding the deaths from cholera, the mortality from all other causes equalled 52·64. The heavy mortality which during

recent years, has been reported in connexion with the Gokak gang of prisoners employed in making extensive canal excavations, has fallen during 1881 to 112·80 per 1,000, against 156·36 in 1880, and a maximum of 401 per 1,000 in 1878. In all the years the chief causes of death were dysentery and diarrhœa, and to these diseases 25, out of a total of 52, deaths during 1881 were attributed.

For some time past the unhealthy condition of the convicts deported to the Penal Settlement at the Andamans and Nicobars has occupied the serious attention of the local authorities and of the Government of India. It is much to be regretted that the health statistics of 1881, though manifesting some, do not on the whole show any marked improvement over those of the preceding three years. The admissions into hospital were, exceedingly high, 2,308 per 1,000, against 2,493 in 1880, the daily sick 99 against 113, and the death-rate 48·02 against 49·65. The ratios for 1881 are certainly a slight improvement on those of the previous year, and it is very satisfactory to be able to report that the information which has been received thus far regarding the results of 1882 (up to October) show that the improvement, which commenced in 1881, has continued and become more decided.

Surgeon-Major James Reid, the senior medical officer, has quite recently submitted an interesting report on the causes of the sickness and mortality; and as his experience of the settlement dates back from 1872, the remarks which he makes have an additional value, on account of his intimate acquaintance with every phase of life in the island. His report brings the information up to the end of March 1882. After a careful analysis of the evidence as regards the suitability of the dietaries in force, and which are pronounced to be good, sufficient, and well adapted to keep prisoners in health, Dr. Reid thus discusses the causes which contribute most largely to the sickness and mortality of the settlement:—

"At the outset I may state that, in my opinion, these causes are in no way due to defective hygienic or sanitary arrangements. There is no question here of improper or insufficient dietary, of want of attention to conservancy, of impure drinking-water, or of deficient air, space, or ventilation. The causes may, in essence, be summed up in one word—they are 'climatic.' The great and permanent cause of sickness here is the malarial, unhealthy nature of the stations on which convicts are located; and so long as it is necessary to locate the bulk of the convicts on them, so long must there be, of necessity, death and sick-rates such as those we have at present. Of all causes of sickness here, this is the most important and far-reaching in influence.

"Ross Island is now almost the only station left us that is decidedly healthy, and on which fever is not endemic. Its death-rates (ranging from 8·0 per 1,000 in 1881–82 to 21·3 in 1878–79) may therefore be said to represent fairly what we might expect in the case of all convicts if they could be located in a similar way on healthy non-malarial stations. The excess of deaths, on the other hand, of all other stations over the Ross rates may be put down as due to the cause I have noted, *viz.*, 'location on a malaria unhealthy station.' This latter statement requires this qualification, however, that convicts living on Ross, though employed on hard enough labour and on exposed out-of-door labour for the most part, are not employed on certain forms of labour which men living on feverish stations have to perform—swamp-reclamation, brick-making, lime-burning, &c. The second cause of sickness here is exposure of prisoners on out-of-door labour to weather. The worst results as regards health are obtained when we have the three following conditions combined:—(*a*) exposure during the rainy season; (*b*) residence on a feverish station; (*c*) employment on swamp or jungle work, or forest work generally.

"As I have already stated, it is found absolutely necessary to employ certain gangs on exposed out-door work all through the rains. But, in addition, for years past convicts have been employed not only on such works, but also on swamp-reclamation works and forest work. Of all employments, jungle work, generally, and reclamation works prove the most unhealthy. The native convict, who, with bare, unprotected feet and legs, is employed in cutting down large trees, undergrowth or secondary jungle, putting together in the creeks rafts of timber or bamboos, rooting up stumps of trees, working in mangrove swamps up to his waist in black mud, is peculiarly liable to injuries while thus employed. In this way, the sickness quickly runs up from these employments; and as all wounds and injuries heal very slowly here, and have a tendency to spread and become gangrenous (especially during the rains), all such cases require a comparatively long residence in hospital. Also, it has been found necessary, for the same reason, to admit into hospital the most trifling cases of wounds and injuries; so apt are they if left untreated to spread and develop into large sores. The result of all the above influences acting for years on convicts has been to bring about this state of matters, that for all settlement work, of whatever kind—swamp and jungle work included—we may be said to have no really healthy men available in many numbers; that the great majority of prisoners are physically weak and unfit for very severe work, and therefore break down quickly under the strain and exposure inseparable from the rougher forms of out-of-door labour. Now, no measures, I submit, can *quickly* change a generally bad state of health like this, which it has taken years to produce, into a highly healthy one. But, with time and careful working of the prisoners on the lines which the causes of sickness above enumerated indicate as natural and proper, something may no doubt gradually be accomplished in raising convict health to a higher level than its present one. In the first place, and as a primary condition, a few healthy stations like Ross are required (*a*) to locate newly-arrived convicts from India on, and allow them to gain strength and get accustomed to the new climate and diet; (*b*) to permit of transfers, from time to time, of sick, weakly prisoners from

feverish stations to regain health. With this arrangement, selected *healthy* prisoners would always be available for jungle reclamation, and pioneer work generally, and such works, if prosecuted *only during the dry season*, would be deprived of much of their bad effects; while, as soon as the rains commenced, the prisoners employed on these works might be withdrawn to the more healthy stations, and employed there on suitable labour and *under cover if possible.*"

With regard to the deterioration which may occur in the salubrity of a once healthy station by reclamation works in its vicinity, Dr. Reid cites the instance of Viper Island, and says that, unfortunately, of late the number of healthy stations in the Settlement has, at least for some time to come, actually been reduced, instead of increased, by the reclamation works which have been prosecuted.

"For years this island had been remarkably healthy and free from fever. But in the course of the present year (May 1881), a reclamation work of mangrove swamp was commenced on the adjacent mainland. Now the rains are generally well in here in May, and the actual rainfall during this month I find recorded as 18·47 inches. The result of this work appears from the statement in the margin. I have given the fever-admissions in all other hospitals for the sake of comparison, as there is every year a rise in the general sick-rates all over the Settlement during the rains. It is easy to see, on looking at the figures, that the increase in the Viper admissions is, out of all proportion, greater than that in all other hospitals, and that, moreover, this increase coincides with the progress of the reclamation works. The admissions for fever shoot up at once in May, when the first *bund* is started, and gradually falling in August, rise again in September with the commencement of the second bund. Not only the prisoners actually employed on these works suffered from fever, but in a more or less degree, all the population living on Viper Island close by—free residents as well as convicts. That Viper Island may again, in course of time, become healthy, when this reclaimed land in its vicinity has been drained and planted over with cocoanut trees, is possible. But our experience hitherto with regard to such reclaimed lands does not lead us to take a very sanguine view. In the meantime we have lost in it one of our few healthy stations, and have had, in addition, a considerable increase to sickness to add to our returns for the year, *due to the prosecution of such works during the rains.*

Months.	Number of Fever Cases admitted:	
	All other Hospitals.	Viper Hospital.
January 1881	730	87
February "	599	72
March "	754	91
April "	726	45
May "	975	2048
June "	1,065	207
July "	1,169	284
August "	807	196
September "	871	247†
October "	967	217
November "	624	352‡
December "	803	192

* Reclamation work commenced—first bund started.
† Second bund started. ‡ (Rainfall 15·27 inches.)

"There is something, however," Dr. Reid continues, "to chronicle by way of gain on the other side. Aberdeen and South Point are two of our oldest mainland stations, yet for years they proved most unhealthy and feverish to all residents on them,—to officers, subordinates, sepoys, free police, and to convicts. In the spring of 1880, Colonel Cadell directed a committee to report on these stations, and devise, if possible, a remedy. The committee recommended that the two swamps close to these stations should no longer have their soil turned over year by year for rice-growing; that, instead of this, grass should be laid down permanently, cocoanut trees planted at proper intervals, and drainage carried out as efficiently as possible. The results of this change I give in the following figures (in the case of Aberdeen):—

Average daily sick per 1,000—Aberdeen.

1878–79	9·6	Average 11·1 while rice was grown and before drainage and planting out of cocoanut trees.
1879–80	12·6	
1880–81	8·4	Average 7·0 after drainage and planting out of cocoanut trees."
1881–82	5·7	

Figures are given to illustrate the result of the change, as regards the station of Aberdeen, which show that, during the period that rice was grown, the average daily sick was about 11 per 1,000; whereas, during the two years which have elapsed since the drainage and other improvements, the average has been about seven. Dr. Reid, writing further in illustration of the evil results which follow disturbance of swampy soil, states—

"That the swamp soil is still as poisonous as ever, and, under *certain conditions*, as fatal to health, is, I think easy of proof. During the rains of the present year, a gang of convicts were employed at *Aberdeen* in clearing the open, swamp drains from grass, weeds, and other obstructions. Sickness of a severe type soon showed itself,—the prominent symptom being jaundice,—and, as I understand, no fewer than 11 deaths occurred directly traceable to this employment. No better example, I think, than this could be quoted to show of what a deadly malarial nature all works connected with swamps and turning over the soil during the rains are. If, by means similar to those adopted in the case of Aberdeen, we can ultimately increase the numbers of our healthy stations (now limited to Ross and Chatham), one great step will have been accomplished. But it must never be left out of sight that those very works to which we look *ultimately* for some permanent improvement in convict health are, *during their progress*, themselves powerful causes in the production of sickness, not only amongst the prisoners employed on them, but also upon those residing in their immediate neighbourhood."

Measures have already been sanctioned and put in hand with a view of improving the health of the convicts. Among these, one of the most important is the locating of new arrivals on a healthy island, and their gradual acclimatisation.

With the object of bringing into prominent notice any remarks as to defects in jail construction, diet, clothing, &c., or suggestions as to improvements, and as to the special causes of sickness and mortality which had been made by medical officers in charge of the several jails of the country, abstracts of the sanitary sheets of each jail were published, for the first time, in last year's Sanitary Report. A similar précis has been prepared of the sheets received in connexion with the year under review. In many instances they have been prepared in a very perfunctory manner, and will not bear serious examination. Nevertheless, as compared with those of previous years, improvement is manifest. Where considerable care has been bestowed in their preparation, the remarks made have been reproduced in greater detail. The strength, admission, and death-rates of each jail are likewise given for convenience of reference; but, as in last year's report, remarks regarding such disease-causes as malaria, climate, &c., have not been particularised.

General Population.

Census of 1881.

This section may be appropriately commenced with a short notice of the general census of British India which was taken on February the 17th of the year under review; a work which, as Mr. W. Chichele Plowden, the Census Commissioner, in his preliminary memorandum* remarks, may fairly claim to be the largest work of the kind undertaken in any country—the enumeration on one and the same day of a population of 252,000,000. It would appear that, in those Provinces and States where the people had been numbered previously, there has been an apparent increase in a population of 218,000,000 of 12,750,000, or 6·2 per cent. In some cases, however, it is believed that the increase is more apparent than real, owing to accidental inaccuracies in previous figures. It is satisfactory to note, Mr. Plowden writes, that where the recorded increase in the number of the people has been most conspicuous—British Burma, Assam, Berar, and Sind—there was ample room for the population to expand. The only parts of the country which show a decided decrease are Mysore—a decrease of 17 per cent.—and Madras—a decrease of 2·4 per cent.; results which are, without doubt, rightly ascribed to the famine of 1877. For convenience of reference, the summarised results of the census of 1881, as compared with the previous census, are reproduced in the following statement:—

Province.	Population according to Census of 1881.	Population according to previous Census.		
	Both sexes.	Both sexes.	Years of Census.	Difference per cent.
Bengal	68,829,920	62,709,405	1871	+ 10
Assam	4,815,157	4,056,054	1871	+ 19
Madras	30,839,184	31,527,972	1871	— 2·4
Bombay	13,978,488	14,038,359	1872	— ·3
Ditto, Native States	6,941,631	6,786,855	1872	+ 2·3
Ditto Total	20,920,119	20,825,214	—	+ ·4
Sind	2,464,934	2,192,415	1872	+ 10
North-Western Provinces (excluding Rampore and Native Garhwal)	32,699,436	30,769,056	1872	+ 6
Oudh	11,407,625	11,219,675	1868	+ 1·6
Punjab (British territory only)	18,766,107	17,511,498	1868	+ 7
Central Provinces	11,505,149	9,251,229	1872	+ 25
Berar	2,670,982	2,231,565	1867	+ 20
British Burma	3,607,646	2,747,148	1872	+ 35
Mysore	4,186,399	5,055,412	1871	— 17
Coorg	178,283	168,312	1871	+ 6
Ajmere	453,075	426,268	1866	+ 6
Baroda	2,154,469	2,000,225	1872	+ 8
Travancore	2,401,158	2,308,891	1875	+ 4
Cochin	600,278	601,114	1875	— ·14
Grand Total of 17 provinces	219,569,918	205,771,353	—	—

* "Gazette of India," September 10, 1881.

Vital statistics.

During 1881 births were registered throughout all the provinces of India, with the exception of Lower Bengal and Assam. In Lower Bengal the system of limited registration has been in force for some years past; nevertheless there has been but little progress effected. Assam inherited the system of selected areas from Bengal, but, it is satisfactory to note, abandoned it to a large extent in 1881, and it is expected that the records of 1882 will embrace a complete set of birth statistics for the entire province. In all the principal provinces the birth-rates were higher than in the preceding year, and the variation between the minimum and maximum was also in many instances less. The excess of male over female births ranged from nearly 4 per cent. in Mysore to about 17 per cent. in the Punjab. In all the provinces the births recorded were in excess of the deaths, with the exception of Coorg and of the municipalities of Bengal.

As in 1880, the birth registration in Bengal Proper was restricted during the year under review to 46 municipal towns, and the average annual ratio was 25·51. In 20 places the ratio was below this average, ranging from 5·92 to 24·68. The death-rate of the province for the year under review was 20·96, which was made up of extremes varying from 7·98 to 42·04. This is the highest average recorded in the Lower Provinces since the commencement of the registration; nevertheless, compared with the statistics of other provinces, it would appear to be still much under the truth. The death-rate among males was 23·02, and among females 18·92; the mortality recorded in the rural circles was at the rate of 20·45 per 1,000, against 33·47 in the towns. According to monthly distribution, the deaths were most numerous in the last three months of the year. The compulsory Registration Act was in force in 112 towns during the year, but great laxity was displayed by the officers concerned in carrying out its provisions.

The registration of births throughout the combined North-West and Oudh Provinces was introduced for the first time in 1879, and the births recorded during that year yielded a ratio of 28·69 per 1,000. This result, attained in the first year of its introduction, was highly encouraging, and the results of the two succeeding years have, to a great extent, fulfilled the hopes which were entertained of further success. In 1880 the birth-rate equalled 32·55, and in 1881 40·34 per 1,000, calculated on the figures of the recent census, and to 41·65, calculated on the population figures of 1872. This improvement was also observable in the statistics of individual districts. Out of a total of 49 districts, only in Kumaon was the ratio below 20 per 1,000 (19·32); in 2 it was between 20 and 30 per 1,000, in 22 between 30 and 40; in 20 between 40 and 50; and in 4 above 50. This general improvement was to a great extent due to the new method of registration introduced during the year, under which every village watchman keeps a nominal register of births and deaths, the reality of which can easily be verified by any inspecting officer; as a matter of fact, many such registers were personally inspected by the Sanitary Commissioner, and in not a single instance was the entry found to be false. Taking the statistics of the province as a whole, the births exceeded the deaths by 8·55 per 1,000. Of the five districts which returned more deaths than births, the excess to an appreciable extent was only in the Terai, where fatal forms of fever were very prevalent during the year. The deaths recorded during the year amounted to 1,402,473, or an equivalent of 31·79 per 1,000. With the exception of the famine years of 1878 and 1879, this has been the highest death-rate recorded since 1870. The increase was apparently due to general improvement in registration, as shown by the statistics of individual districts. Among these the death-rate in 19 ranged between 20 and 30 per 1,000, in 28 between 30 and 40, and in two it was above 40. The highest mortality was in the Terai district, the next highest in Cawnpore, and the lowest in Dehra and Kumaon. With the exception of Partabgarh, the deaths among males in every district exceeded those among females, and the average excess for the province was at the rate of 13 per cent. The ratio of deaths in the rural circles was 31·39 against 37·80 in towns. Among the 100 towns in the province, the highest death-rate was at the town of Ajudhia in Fyzabad, where it equalled no less than 115·26 per 1,000, 81·68 being contributed by fevers alone.

Although 1881 was only the second year in which births were registered throughout the Punjab, the results obtained were highly satisfactory, and an examination of the detailed statements reveals marked progress in all the districts of the province. In 1880 the birth-rate was 31·15, but in 1881 the 695,766 births recorded in the province yielded a ratio of 39·79. In only two districts, Simla and Peshawar, were the birth-rates below 20 per 1,000, viz., 15·84 and 18·54 respectively. It is to be noted, however, that these figures are much in excess of what they were in the previous year. In five districts it varied between 20 and 30, in 10 between 30 and 40, and in 15 between 40 and 48. The births of boys exceeded those of the girls by 16 per cent.

against 21 in the preceding year. Excepting the four districts of Simla, Kangra, Amritsar, and Peshawar, the births were everywhere more numerous than the deaths. The results for the province, as a whole, indicated an excess of 10 per 1,000. In the year under report, 519,779 deaths were registered, against 472,731 in 1880, or an equivalent of 30 per 1,000. This excess was due to considerable increase in the deaths from cholera, fevers, bowel complaints, and other diseases not separately classified. In the rural circles the death-rate was 28 per 1,000, against 48 in the towns. According to monthly distribution the deaths were more numerous during the last four months of the year.

The results of birth registration in the Central Provinces during 1881 were much more satisfactory than in any year, from 1876 onwards. In the year under report, the lowest ratio, 37·91, was in the Burhanpur district; all the other districts returned a birth-rate of over 41 per 1,000 with a maximum of 59·39 in Murwara. The average for the province, as a whole, was 48·94. The statistics of the municipal towns, however, were not so satisfactory; still, compared with the figures of the year previous, they indicate some improvement, and it is expected that a strict enforcement of penalties, which the Chief Commissioner has now ordered in cases of breaches of the municipal bye-law regarding registration, will serve to ensure better results in future. The number of male to every 100 female births was exactly the same as in 1880, viz., 108; in all the districts the births were considerably in excess of the deaths, and the total births of the province exceeded the deaths by a ratio of 16·36 per 1,000. With few exceptions, the births were proportionately more numerous than the deaths in the towns also. In 1881 there was an abundance of food-grains in the province, and prices were generally low. But the death-rate for the year was 32·58, against 29·10 in 1880. This increase was probably due in part, at all events, to the improvement effected in registration, and in part to the somewhat unhealthy character of the year. There was a considerable rise in the mortality from cholera as compared with the preceding year, as also from fevers, bowel complaints, and "all other causes." In six districts the death-rate was under 30 per 1,000, the lowest being in the Burhanpur district, 26·58; in 12 it was between 30 and 40 per 1,000; and in two it was above 40 per 1,000, the highest, 43·93, being in Narsingpur. On the whole there were 116 male deaths for every 100 deaths among females. The total death-rate in towns was 40·65 per 1,000 of population against 32·02 in the rural circles.

The results of the recent census have disclosed that, during the interval between 1867 and 1881, there has been an increase of 20·3 per cent. in the population of the Province of Berar, raising the total number from 2,186,988 to 2,630,018. In comparing, therefore, the results of registration in 1881 with those of the preceding years, the fact should not be lost sight of that the ratios of the year under review have been calculated on the figures of the recent census. The aggregate of the male and female births recorded during the year was 104,921 against 91,105 in 1880, which again was the highest number attained since the commencement of the registration in 1871. But, for the reason already explained, the birth-rate of the year was nominally lower than that for 1880—39·9 against 41·7. Were the births calculated on the census of 1867, the ratio for 1881 would be 48·0. In all the districts the births were considerably more than the deaths, the average excess for the entire province being 10·7 per 1,000 of population. The figures for individual districts indicate that a decided improvement has been effected throughout the Hyderabad Assigned Districts. The local Sanitary Commissioner, however, considers that the figures recorded are still under the truth, and it is expected that the working of the revised registration rules will secure better results in future. As was noticed in the last annual report, the birth registration in towns was defective as compared with the results attained in the rural circles. Orders have, however, been issued to the district officers to rectify the defect. After the famine which prevailed in Berar during 1878, the total deaths in each of the two following years were between 51,000 and 52,000. In 1881 the number rose to 76,661, or to an equivalent of 29·1, against some 23 per 1,000 in the two preceding years. This increase of upwards of 24,000 deaths may, to some extent, have been due to improvement in registration as claimed by the Sanitary Commissioner of the province; but the increase was also, doubtless, due in part to epidemics of cholera and other diseases, the former having been almost wholly absent in the year previous. The variations in the ratios of individual districts was not so great, as is usually the case in other provinces—they ranged from 25 in Wun to 33 in Akola. The number of males who died to every 100 deaths of females was 114·6 against 119·6 in 1880. As in the case of births, the results of death registration in towns were also less satisfactory than in the rural circles, the total ratio for the year being 28·4 in the former, against 29·2 in the latter.

The census figures of 1881 were likewise adopted in British Burma as the basis for calculating the ratios of births and deaths. In attempting to compare the ratios of the past year with those of the years which preceded it, the results of 1881 are as elsewhere under similar conditions at some disadvantage; for according to the recent census, the population of British Burma has increased by 577,859 persons. The total number of births recorded was 73,754, a birth-rate of 19·98 per 1,000 of the population against 23·16 in 1880. The number of boys born to every 100 girls was 106 against 107 in 1880; and the excess of births over deaths, which was almost general throughout the province, was 4·23 per 1,000. The total deaths registered was 58,136, against 55,185 in the year previous, or a ratio of 15·75 against 17·72. The registration had greatly improved in many of the towns, but still in several of them the results left much to be desired. An average death-rate of 27·78 was recorded for the towns as a whole, and 14·22 for the rural circles. Although these results do not appear to be very satisfactory on the whole, compared with the statistics of other provinces, it is to be remembered that there are exceptional difficulties to be overcome in Burma, and there is evidence to show that the collection of vital statistics is improving year by year.

In 1880 the registration of births in Assam was restricted to eight towns. In 1881 it was introduced into six out of the eight districts of the Province. Of the other two districts, it is said that in Sylhet it will be commenced from 1st July 1882, and that in Cachar, although the registration of births has been in force for many years, by an oversight, these statistics have not hitherto been furnished nor embodied in the Sanitary Report of the Province. In Assam, also, the census figures of 1881 form the basis of calculating the ratios of vital statistics for the year under review; and this is an additional reason why comparisons between the statistics of 1881 and 1880 cannot be satisfactorily instituted. The birth-rate of the year, 19·25 per 1,000, exceeded the death-rate by 2·27. Great attention has been paid to the collection of vital statistics in this Province, and the Chief Commissioner, in his Resolution on the Sanitary Report, states that "compulsory registration has been extended to all municipalities, and to several other local "areas. . . . Efforts have been made to secure a uniform system of reporting, and to arrange that no area may escape registration. . . . In parts of the Khasi and "Jaintia and Garo Hills a tentative system of record is being started." Managers of tea gardens also have been directed to submit similar statistics as regards births and deaths occurring amongst their coolies. As in previous years, deaths were registered throughout the province, and the total number for the year was 71,941, against 51,666 in 1880. But, notwithstanding the marked improvement which has been effected in registration, the results are still far from satisfactory. The ratio of mortality for the entire province, 16·04, varied from 6·87 in Cachar to 23·71 in Nowgong; and the male deaths exceeded the female deaths by 21 per cent. Imperfect as these statistics certainly are, they are nearer the truth than those of the year previous, when the death-rate was only 13·61, and the number of male deaths to every 100 deaths of females was 136. The ratio of deaths in the towns was 23·46, and in the rural circles 15·95.

Notwithstanding that vital statistics have been collected during the last 13 years in the Madras Presidency, the results are more defective than those of several of the provinces of the Bengal Presidency. It is, however, satisfactory to find that the ratio of births recorded in 1881, 25·5 per 1,000, was higher than in any of the twelve preceding years, and that it stood at double the rate to which it was reduced in the year following that of the famine of 1877. The number of males born to every 100 girls was 105, or the same as in 1880. The excess of births over deaths was 9·3 per 1,000. In the report for 1880 it was noticed that the prices of food-grains were low as compared with previous years. In 1881 there was further reduction in the prices, but the general health was not so satisfactory as in the preceding year. The prevalence of cholera in the southern districts of the Presidency during the last three months of the year added largely to the mortality, and there was also some increase in the deaths from small-pox and injuries. The death-rate of the Presidency, in consequence, rose from 15·7 in 1880 to 16·2 in 1881. These ratios, however, can hardly be taken as representing the true mortality. In several of the provinces of Upper India the death-rate was almost double the ratio for 1881 in Madras. Tested by the results obtained in the Presidency towns, it would appear that the ratios of individual districts are still very defective. In four of the districts the number of deaths recorded under females was in excess of the deaths registered under males. In the rural circles the death-rate was 15·8, against 22·8 in the towns.

The total number of births registered in the Bombay Presidency during 1881 was 459,657, or 88,784 more than in the year previous, the figures of which were again in excess of those for any year since 1872. The male birth-rate was 14·58 per 1,000 of

population, the female birth-rate 13·35, and the ratio for both the sexes taken together 27·93. This ratio, although calculated on the census of 1881, which showed an increase of 225,640 to the population of the Presidency, is yet considerably higher than that attained in any of the preceding nine years. It is satisfactory to note that this improvement was very general throughout the Presidency. The proportion of excess of male over female births was also nearer the truth than in 1880. These results indicate the improvement that has been effected in the matter of registration since the amalgamation of the Vaccination with the Sanitary Department. With few exceptions, the births in all districts exceeded the deaths; and the average excess for the Presidency during the year amounted to 4·75. In many of the towns, however, including the city of Bombay, the results were not very satisfactory. The total number of deaths reported during the year was 381,450, or an equivalent of 23·18, according to the recent census. The male deaths exceeded the female deaths by 12·7 per cent., against 16·4 in 1880. The mortality was heaviest during the last five months of the year, the maximum number of deaths having been in August. The average death-rate of the towns was 29·07, and of the rural circles 22·32. The increase in the total number of deaths compared with 1880 was, possibly, in part due to improvements in registration, but it was, in the main, due to the prevalence of epidemic cholera from June to October.

Compared with 1880, there was some improvement in the registration of vital statistics in Mysore. The mean birth-rate of the province during 1881 was 23·70, against 17·27 in 1880. In nearly all the districts a larger number of boys was born than of girls. The births exceeded the deaths throughout the province, the total excess amounting to 6·68 per 1,000. The total death-rate of the year was 17·02, against 15·78 in 1880. The average death-rate of rural circles was 17·06, against 16·24 in towns. In Coorg the birth-rate was 15·86, against 11·95 in the year previous. The ratio of males born to every 100 females was 105·60 against 109·80. The results of death registration in this province, however, were not very satisfactory. In 1880 the ratio was 21·46, and in 1881 it fell to 17·90.

As mentioned in last year's report, the death registers of cantonments in the Bengal Presidency and Hyderabad Assigned Districts are now received direct by the local Sanitary Commissioners, who furnish a summary of the registers of their respective provinces to this office month by month. As in the preceding year, the lowest death-rate (3·36 per 1,000) in 1881 was among the natives at Fort William. The maximum mortality was at Amritsar, 93·82 per 1,000.

Cholera.

As mentioned in last year's report cholera was comparatively little prevalent over great part of India during 1880. In 1881, however, not only was the distribution of the disease more general, but its incidence in nearly all provinces was more severe; the aggregate number of deaths registered in British India rose from some 118,000 in 1880 to 161,000 in 1881, or an increase of about 43,000. As compared with 1879, however, the returns of 1881 show a diminution in the cholera deaths of considerably over 100,000.

Province.	Population.	Deaths from Cholera.							
		1874.	1875.	1876.	1877.	1878.	1879.	1880.	1881.
Bengal*	59,878,497	56,876	109,988	196,590	155,805	95,192	136,363	89,643	79,180
Assam	4,483,705	16,478	6,618	8,615	11,377	6,732	17,415	2,803	5,010
North-Western Provinces and Oudh	44,107,869	6,464	64,427	48,311	31,770	22,231	35,892	71,546	25,865
Punjab	17,487,125	78	6,245	5,736	29	215	26,135	274	5,207
Central Provinces	7,409,865	14	14,643	20,124	2,418	40,985	27,575	330	9,140
Berar	2,636,018	2	22,465	2,683	882	34,366	223	1	3,404
Rajputana	‡	†	1,203	283	60	2,393	918	—	197
Central India	‡	†	2,555	1,929	926	8,047	2,734	299	581
Bombay	16,454,414	37	47,573	32,117	57,228	46,743	6,937	684	16,694
Hyderabad	‡	†	10,891	5,582	7,414	6,696	6	—	1,721
Madras	28,676,375	318	94,547	148,189	357,430	47,167	13,296	613	9,446
Mysore	4,186,188	†	2,504	12,087	2,902	723	14	25	25
Coorg	178,302	†	†	210	†	49	—	—	3
British Burma	4,692,263	950	761	3,678	7,276	6,759	1,823	2,638	5,239

* Excluding Calcutta. † Statistics not available. ‡ Population not known.

The above tabular statement shows that, whereas the mortality from cholera in Lower Bengal and in Assam during the year under review was about double what it was in 1880, in the Punjab the deaths rose from 274 to 5,207, in the Central Provinces from 330 to 9,140, in Madras from 613 to 9,446, and in Bombay from 684 to 16,694. The number of deaths in the North-Western Provinces and Oudh fell from 71,546 to 25,865; these combined provinces stand alone as showing a decrease during 1881, just as in the previous year they stood alone in showing exceptional prevalence.

In last year's annual report, when considering the exceptional immunity which large tracts of the Bengal Presidency had experienced during 1880, prominent attention was drawn to the history of coolie emigration during recent years, especially as regards the mortality which had occurred amongst coolies proceeding through Eastern Bengal to Assam. It had been maintained that the marked exemption from cholera amongst these emigrants during 1880 was solely due to improved arrangements which had been made in the water-supply of the steamers in which they were carried. But the variations in cholera mortality amongst the general population of the districts through which the coolies passed were just as marked, and even more marked, than amongst the emigrant coolies themselves. "The evidence," it was remarked, "so far as it yet goes, seems to prove "only that there has of late been a remarkable diminution in cholera over those parts of "the country which the emigrants traverse, and that from this the emigrants benefited in "common with the inhabitants of those parts." In the earlier part of the current year (1882), a striking illustration of the general correctness of this view was furnished by the experience of four steamers during their passage with coolies up the Brahmaputra, when 62 deaths from cholera were reported out of a total of 1,791 emigrants: one of the steamers—the "Nepal"—with 484 coolies, lost 40 emigrants from this cause during the month of March. The accommodation on board and all the arrangements were pronounced to be good, and the only explanation offered as to the probable cause of the outbreak was that the disease may have been imported at one of the embarking stations. It does not seem to have occurred to those who gave an opinion on the matter that some light might be thrown on it by ascertaining whether it had or had not prevailed at the same time in the districts through which the immigrants had passed. As a fact, the general population were at that time suffering much more than they had done for years. The statement in the margin gives the cholera deaths in all the districts of the Assam valley in February and March of the last three years, from which it is evident that in both these months of 1882 cholera was much more prevalent than it had been in either 1881 or 1880; and, what is of still more importance, that in Kamrup—the district through which the vessels were passing when the outbreak chiefly occurred—the number of deaths from cholera, which in February 1880 had been 40 and in 1881 only 10, rose in 1882 to 210. For March the figures are 46 for 1880, five for 1881, and 734 for 1882. It requires but very little reflection to see that the cause from which the coolies suffered, whatever it may have been, must have been widespread, and that any explanation of the outbreak which applies to the coolies only and leaves the people generally out of account could but have proved futile. Of the importance of providing a pure water supply there can be no two opinions, and, as was remarked in last year's report, it is to be hoped that the results of future years may show that the reforms introduced on board the Assam steamers have aided in reducing the mortality among the emigrants; but in such obscure and difficult questions as those which relate to cholera, hasty conclusions which deal with only one set of facts and exclude all others can only lead to error.

Cholera in Assam during February and March 1880, 1881, 1882.

Districts.	February.			March.		
	1880.	1881.	1882.	1880.	1881.	1882.
Lakhimpur	1	0	5	0	0	1
Sibsagar	1	4	1	2	0	0
Nowgong	57	6	9	25	5	87
Darrang	1	0	23	2	0	37
Goalpara	7	0	30	7	0	5
Kamrup	40	10	210	46	5	734
Total	107	20	287	82	10	864

The practical lesson which the experience of these three years amongst coolie emigrants of the Assam valley inculcates is a very important one, though it is but one more added to the number of lessons so frequently taught in connexion with the management of troops and pilgrims. If men, and especially men wearied by travel, underfed or improperly fed, pass through a place in which cholera prevails, they are very liable to be attacked, and that in a larger proportion than the ordinary residents. When bodies of men have to pass through cholera-affected localities, they should do so rapidly—any attempt at quarantining them in such territory would be cruel, and would be analogous to detaining persons in a malarious swamp, lest they should disseminate the fever they had contracted in it in another part of the country.

In several instances, during the course of the year, attempts were made by local authorities to obtain sanction for the enforcement of quarantine, with the object of controlling cholera. For example, in September, the Commanding Officer introduced what were virtually quarantine restrictions into the Julundur cantonment, with the object of protecting the residents from the disease during a period of its prevalence in the neighbouring town. As this procedure was not only a violation of the cholera regulations in force, but also at variance with the practice which has been found to be most

satisfactory all over the country, it was immediately countermanded by His Excellency the Commander-in-Chief: "No reasons," it was stated, "have been advanced in favour "of relaxing this rule at Jullundur, which might not be applied to any other cantonment "during a time of cholera prevalence; and, in view of the very strong opinion expressed "by competent authorities, that no benefit can be derived from the enforcement of "quarantine, and the strict orders that have from time to time been issued against its "establishment," it was ordered that "all restrictive measures may, in the present "instance, be limited to preventing the military as well as native establishment and "followers from visiting any places in which cholera exists, all such places being, as far "as practicable, put 'out of bounds.'" The quarantine restrictions were thus immediately withdrawn, and although the disease was very prevalent in the town and neighbourhood of Jullundur, the cantonment almost wholly escaped. Had the quarantine restrictions been sanctioned in this instance, it need hardly be said that the exemption of the cantonment would have been attributed to the action of the local authorities, and the case would have been cited as evidence of the value of quarantine as a protection against cholera.

Again, in April 1882, the Officer Commanding, Thayetmyo, having learnt that two cases of cholera had been imported into the station by one of the Irrawaddy steamers, suggested the introduction of various restrictive measures, regarding which the Chief Commissioner observed that they "amount to a proposal that quarantine should be "established against all river steamers on which may be found 'any people suffering "'from serious disorders.' The Chief Commissioner knows of no legal power to establish "such quarantine on river craft. . . Such quarantine would, in the case of an epidemic "probably do more harm than good. It would confine the passengers and crew in a "small and possibly infected area. It might keep alive and intensify an epidemic. "Unless they were kept on the steamer till all died, some of the passengers must "eventually come on shore." Consequently, Mr. Bernard decided that he could not sanction the proposed quarantine "without much stronger grounds than have as yet been "brought forward."

The experience of fairs and other gatherings in this country has, again and again, testified to the truth of the conclusion, that cholera is not carried by persons from one locality to another, so as to cause persons not themselves exposed to the necessary local influences to become affected by the disease. Coincidences certainly can be cited, in which the arrival of persons from a cholera-affected district has been closely followed by an outbreak of the disease; but even these coincidences are far fewer than is generally supposed. An illustration of such a coincidence is furnished by the history of the great fair—*Magh méla*—which was held in January 1882 at Allahabad. On this occasion the *méla* was of a special character—it was a *Kumbh* méla, which recurs only every twelfth year, and was consequently very large. The fair lasted from the 5th of January (the first day of the month of *Magh*) to the 3rd of February; but the great bathing day was on the 19th January, when it is believed that nearly a million of people were congregated together at the confluence of the rivers Ganges and Jumna. These people had collected from all parts of India. Between the 16th and the 23rd January numerous cases of cholera occurred, among them 231 having proved fatal. The slight outburst of cholera which followed the fair, occurring as it did at an unusual time of the year, attracted some attention, and the general impression was that it had been caused by the dispersion of the pilgrims. But the facts will not bear such an interpretation. Allahabad is a central station, and lines of railway diverge from it in various directions; but it is worthy of special note that it was only in districts more or less closely located along the southern line of railway that cholera was reported during this period. In the district of Jubbulpore 97 persons were attacked between 21st of January and 5th February, the dates apparently of the first and last cases. For the most part it is believed that these cases occurred amongst persons who had been at the Allahabad méla, which is only 12 hours by rail from Jubbulpore, and many of them had been taken out of the train affected with the disease. How many persons suffered, other than those who had been to the méla, is not quite clear from the records; but this inquiry is of the less importance, as it is quite clear that the registers of nearly all the districts along this line of railway give indications of the presence of cholera in them, even before any case of the disease had been witnessed in Allahabad, and before the pilgrims could have dispersed. As considerable attention has been drawn to the cases of the disease which occurred at Jubbulpore and other places in this direction, as illustrating the possibility of the disease being spread from a given focus by human intercourse, a very careful examination of the statistics of the country within a radius of 200 miles from Allahabad during this period has been made, and a map was prepared showing the days

in January when the first cases occurred. This inquiry demonstrated that deaths from the disease were reported in villages at some distance from Jubbulpore, and away from the line of rail on the 2nd, 10th, and 11th of the month; that is to say, before any case had occurred at the Magh mêla; and on the 17th, deaths were reported in two districts, simultaneously, at a distance of from 30 to 40 miles from the railway at Jubbulpore. Moreover, the district of Damoh, which is much more inaccessible from Allahabad than any other district in these parts, suffered much more during January than any other; 329 deaths were registered in this district, against 35, for example, in the district of Jubbulpore. At Banda, some 60 miles to the west of Allahabad, and away from the line of rail, deaths were reported on the 8th January, and cases continued to occur during the whole month, though the first cases must have been wholly unconnected with the outbreak at the Magh mêla. When it is further considered that along the lines of rail proceeding in a north-westerly and in the opposite direction the districts suffered remarkably little from cholera, though many deaths amongst the pilgrims had occurred at various railway stations in these directions also, it becomes abundantly evident that the occurrence of the disease in the districts along, and for some distance beyond, the Jubbulpore railway about the same time that deaths amongst the pilgrims took place at the railway stations was merely a coincidence, and that even the force of the coincidence is materially diminished by the circumstance, above narrated, that the disease had been registered amongst the people of the district before any pilgrims could possibly have reached their homes. A careful scrutiny of the facts, which have thus been collected, fully bears out the statement of the Sanitary Commissioner of the North-Western Provinces and Oudh, who was present at the fair, that, though dying and dead persons were taken out of the train in all directions of the lines of railway, the "disease "only troubled the pilgrims who had been to Allahabad, and did not affect residents who "stayed at home;" and this assertion is further borne out by the Commissioner of the Allahabad Division, who in his report states that, though the deaths among the returning pilgrims were numerous, the epidemic did not spread, and the mortality ceased with the arrival of the pilgrims at their homes.

During the last two years the cholera statistics of European troops in India have been very favourable—a death-rate of 2·3 in 1881 against 2·8 in 1880, and 11·0 in 1879. Of the 137 deaths which were registered during 1881, 116 occurred in the Bengal Presidency, 80 of them being in the Punjab. As regards Native troops the results were also favourable, though the number of deaths was greater during the year under review than during the previous year. This matter has, however, already been referred to in the sections of the report devoted to the troops, and to these reference may be made for detailed information. As regards the history of cholera amongst prisoners reference should also be made to the section of the report which deals with them. But it may be stated here that there were 306 deaths from the disease among the jail population of the country, nearly 200 of which were returned by the jails of the Bengal Presidency, and that the mortality returns of the year were, under this heading, not so favourable as were those of 1880, but much more favourable than those of the years 1877 to 1879.

For several years past, special reports have been prepared of every cholera outbreak which has occurred amongst European and Native troops, and amongst prisoners, by the medical official in charge. A standard form is issued, with a series of questions printed on one side of the page, and blank spaces for replies on the other. The information thus collected has been summarised year by year, the replies from each presidency and from each section of the community being grouped under a few general headings, such as effects of fatigue and exposure in inducing the disease; the atmospheric phenomena observed during the outbreak; evidence of importation and of subsequent diffusion of the disease, &c.

As regards the probable influence of unusual fatigue, exposure to weather, or excess of any kind in inducing cholera, one medical officer writes of a case which occurred at Meerut: Had suffered much from ague last year and was reported to have been drinking rather hard for a few days previous to the attack. Another writes that the patient was attacked ten days after having been released from a 42-days' imprisonment; and a third, "During the previous 10 days had been confined in the guard-room, "awaiting trial by court-martial for drunkenness." One of the men attacked at Meean Meer is reported to have eaten a quantity of green, unripe plums; he then went to the plunge bath and remained there some time, and said that he had felt cold and had rigours after coming out of the bath. The disease is frequently attributed to recent intemperance, and to irregular habits amongst European troops, though very frequently cases are cited in which nothing of the kind can be adduced. As regards Native troops

also, recent irregularities of various kinds are cited, as, for example, in the following instances: the man ate very heartily of meat and bread on the previous evening, and drank a considerable quantity of butter milk. It being the month of Ramzan, he had not eaten or drunk anything after sunrise of the day on which he was attacked. Another man was a bad character: On the day of attack had been drinking freely of the lowest kinds of liquor, and had eaten a large number of custard-apples. In the evening continued drinking and performing gymnastics on a tree (where he is said to have had a fall) along with a friend of his, who also had an attack of cholera later on. A third case had, on the morning of attack, been to the bazaar, and had returned tired; went to sleep in the verandah of his barrack, and was there exposed to cold and wet. As regards prisoners, exposure is occasionally cited as inducing causes; and, in one instance, the medical officer writes of a case which occurred in a man under sentence of death—"It is possible that the severe mental depression, consequent upon his capital "sentence, may have served to develop the attack. Fear and other depressing nervous "influences exercise a very appreciable effect in the causation of cholera." In the majority of outbreaks more or less marked evidence of premonitory diarrhœa was observed, though in not a few nothing of the kind was observed. One officer writes: "There were a few cases of diarrhœa which developed suspicious symptoms simulating "those of cholera, with prostration and more or less marked collapse about the time "when cholera cases were being admitted. In other instances cramps and vomiting "accompanied the diarrhœa, but no suppression of urine." At Kamptee it is stated that the number of diarrhœa cases increased towards the end of the outbreak; whereas at Dinapore and several other places the cases were most numerous immediately before and during the outbreak.

Nor are any atmospheric phenomena referred to which are characteristic of seasons of cholera outbreaks. For the most part the air is described as close, damp, and sultry. The medical officer of the 2-22nd Regiment at Allahabad states that there was a heavy sandstorm, preceded by intense stillness of the air. The heat was great and the wind easterly. Somewhat similar phenomena were observed at Meerut. At Morar there was thunder and rain on the day in which the first European was attacked. At Meean Meer the weather is described as having been hot and cloudy; a sandstorm passed over the station during the period of outbreak, and there was also a little rain "followed by "that peculiar and characteristic graveyard odour which is always noticeable at Meean "Meer after early showers of rain in the hot weather." Other medical officers at this station describe the atmospheric phenomena of this period in a somewhat similar manner; and one, when referring to the occurrence of the disease at the adjoining fort of Lahore, writes: "There has been an unusual amount of rain this season, and the connection "between it and the cholera cases appears to be distinct, the cholera appearing after the "rain." At Amritsar a similar state of the weather was observed, "the rainfall "previous to the outbreak was excessive." In other places, on the other hand, outbreaks are recorded which were not preceded by any rain, though in most instances atmospheric disturbances were observed. As regards the direction of the wind, nothing distinctive can be detected in the reports. One writer observes: "The course of the "wind was erratic, but the prevailing wind was westerly, and the general course "of the disease appeared to be against it." Writing of the cases which occurred in the Lahore central jail the medical officer observes: "The rainfall seemed to be "attended with an increase of cases and prejudicially affected the sick—cases that "seemed to be getting well suddenly got worse. Ultimately the disease suddenly "ceased after a very heavy fall of rain attended with thunder and lightning. The "wind, which had steadily been in the east, veered round and blew for about a week "after the storm from the west."

In only very few instances is evidence seriously adduced in support of the view that the first case during an outbreak of the disease was imported from a previously affected locality, and that subsequent cases were due to personal communication with the first. But the possibility, or rather the probability, of such having been the case is frequently assumed. For example, a medical officer, speaking of the disease at Kamptee, writes: "No direct communication traced, but it is considered probable that there was indirect "communication." Of the few instances of supposed direct communication with cholera-affected persons, and consequent infection, the following may be cited: The medical officer of the H-1st R.A., Jullundur, writes: "It is supposed that the infection "was imported by the R.A. dooly-bearers, who slept in the verandah of the guard-"room, under the window of the 'day room,' where the prisoner was confined." These statements, and many others of a similar kind might be cited, are in reality but

expressions of opinions, and cannot be accepted as evidence to be examined and weighed in the settlement of any question connected with cholera.

A tabular statement has been prepared (though not printed) of the replies which have been furnished to the questions: "The number of buildings occupied by men and "families? The number of these which furnished cases?" An examination of the figures thus collected is instructive, as showing the great discrepancy which exists during different outbreaks, and at different places in a particular town during the same outbreak, as to the proportion of buildings attacked to the proportion which escaped. In some cases, when the aggregate number of occupied buildings was very small, all or nearly all were found to have furnished cases; in others the proportion of affected buildings was very small, under one per cent. In the statement above referred to, some 10,500 buildings, such as barracks, jails, asylums, &c., are enumerated as having come under review, and of these 335 furnished cases of cholera, or at the rate of about 3 per cent., a result which is not compatible with the general belief so readily accepted of late years that the disease is easily transmissible from person to person and from house to house.

For some years past records have been collected of the number of attendants on cholera patients who have themselves been attacked by the disease. The mere fact that a person who has been attending on a cholera patient has been attacked by cholera is not unfrequently recorded as a sufficient proof that the disease had been communicated from the sick to the healthy. Judging from such reports, it would seem to be expected that attendance on cholera sick should actually confer immunity from attack. The fact is wholly ignored that the sick are usually treated at or near the place where they were stricken with the disease, and that the attendants are subject to similar local influences. Owing to these and to the enervating effects of prolonged and constant attendance, the disease might be looked for more commonly amongst the attendants. But actual figures do not support this expectation. During 1881 records have been kept, as will be seen from the marginal table, of 861 cases of cholera which had been attended by 1,746 persons; but of this large number of attendants, only 36 were attacked, or at the rate of 2 per cent. This is by no means a high proportion of cases amongst persons living in a cholera-affected locality, nor is the proportion exceptionally low as compared with previous years. On the contrary, as compared with 1880, it is considerably higher, and the ratio is nearly identical with that obtained from the figures which have been collected during the last five years—1877 to 1881—when, out of 7,859 attendants, 149 were attacked, or equal to 1·9 per cent. In the face of such statistical evidence as this it is not necessary to examine isolated instances in which the disease is supposed to have been contracted by attendance on the sick. It is the fact of dwelling in a locality where cholera-producing influences prevail which constitutes the danger, and not contact with an affected person.

The Number of Attendants on Cholera Patients attacked by the disease during 1881.

Communities.	Number of Cases of Cholera.	Number of Attendants.	Number of Attendants attacked.
European troops	217	402	5
Native troops	167	725	14
Prisoners, &c.	477	619	17
TOTAL	861	1,746	36

Many replies have been furnished to the inquiry as to the existence of defects in drainage, water-supply, conservancy, accommodation, &c., but as, in most instances, the information has been given in the sanitary sheets, &c., already summarised in other sections of this report, it is not necessary to repeat here what has been more or less fully recorded already. A few of the more serious sanitary defects noted may, however, be referred to. As regards Dum-Dum, it is stated that there is no subsoil drainage; that the water is obtained from tanks; that the latrines are offensive; and that the guard-room in the first case had been for 24 hours previously in an unsuitable and badly ventilated building. At Meean Meer the surface drainage is reported to be defective; and it is said that, before the outbreak of cholera there, a branch of the canal was sometimes dry from imperfect and irregular flushing, so that offensive smells were emitted in close proximity to the barrack where the disease appeared. The water-supply of the Native troops at Bhagalpur is described as being not good, and similar reports are furnished as regards several other stations, but they do not call for special remark.

On the whole, the reports on the effect of movement of troops and prisoners from affected localities are exceedingly favourable. The medical officer of the Seaforth Highlanders at Lucknow writes: "Movement successful; general health of the men "improved;" and regarding the effect of movement at Govindghur it is stated—

"Removal to camp Harupa had a very beneficial effect." As regards Meean Meer, it is stated that the first move was not successful, having been only a short distance from the barracks, but movements to a distance, along the line of rail towards Mooltan, were attended with complete cessation of the disease, which was all the more remarkable, because on two occasions when the troops returned to the cantonments, cholera appeared among them afresh, and disappeared again on their return to camp. At Kamptee, also, the first move was not successful. The prisoners of the Lahore central jail had to be moved on seven occasions. No cases of cholera were reported in connexion with the last three moves. It should be noted that the disease was very prevalent at Lahore and in other parts of the Punjab.

In connexion with this outbreak of cholera a special committee was appointed in September 1881. This committee, which consisted (as was stated in last year's annual report) of a President and of three members, the Sanitary Commissioner of the Province being the medical member, visited the various places embraced within the area of the epidemic almost immediately after it was convened; and a report is now being drawn up for submission to the Government, giving a detailed history of the disease as it occurred amongst the troops, prisoners, and the general population. It is to be regretted that so long a period should have elapsed before the results of the committee's deliberations are published; but the inconvenience of the delay will be far outweighed by the advantages which will result should the committee be able to recommend measures for dealing more effectually with future epidemics of this kind.

The history of cholera in India during the year under review would be incomplete without reference to the sudden outbreak at Aden during the month of August. This was the first appearance of cholera at this port since 1867, an interval of 14 years, and it is the first occasion on which an opinion has been advanced that the disease had been conveyed to this station by means of shipping from an Indian or any other port. The circumstances attending the outbreak are interesting from an epidemiological point of view. The sudden appearance of the disease had been ascribed to germs carried in a steamer along with bags of rice from Bombay. The question was thus eminently practical in its bearing on commerce, and the evidence was therefore very carefully examined by the Government of India immediately on receipt of the report of the special committee which had been convened to investigate the matter on the spot. The following extract from a memorandum, which was prepared for the Government, serves to show how wholly insufficient are the facts narrated by the committee to support the conclusion that the disease had been transported from Bombay. The whole case illustrates the readiness with which such explanations as to the causation of cholera are accepted in Europe—accepted in this instance before the special committee had submitted its report, and when, consequently nothing but the crudest information could have been available:—

> The second point in these papers is the question whether the Aden cholera of August and September 1881 was or was not introduced by the S.S. "Columbian" from Bombay. In December last the Secretary of State observed that it was apparently admitted by the authorities at Aden that the outbreak at Aden was due to this ship. In Home Department letters, No. 10 of 21st January, and No. 26 of 31st idem, full particulars were called for on this subject, and the local authorities were asked for a categorical expression of opinion upon it, with a statement of the precise grounds on which their opinion was based. The information collected has now been submitted. There is the report of a special medical committee which assembled on the 28th October 1881; there is a separate memorandum on the committee's report by Deputy Surgeon-General Moore, who happened to be at Aden when the committee met; there are several letters from the Resident, and there is a memorandum by the Secretary to the Government of Bombay, summarising the facts so far as they were ascertained. The Bombay Government express no opinion on the point, but the committee, Dr. Moore, and the Resident, all appear to have no doubt that the outbreak at Aden was due to the S.S. "Columbian." In endeavouring to form correct conclusions in this very important matter, it is essential to separate fact from theory. The committee are of opinion that some of the bags containing the rice cargo of the "Columbian" had been tainted by cholera discharges at Bombay, where cholera at the time was somewhat more* prevalent than usual; that in this way, the germs of cholera were conveyed to Aden, and affected certain coolies employed in unloading the vessel on the day of her arrival. The existence of a cholera germ, and the presence of this supposed germ in the discharges of a cholera patient, are hypotheses which, although accepted by many, can by no means be put forward as facts. But, in order that the Aden authorities may have the strongest case possible, let it be assumed that these hypotheses represent facts and not mere theories; let it be assumed that cholera discharges really do contain cholera germs. The

Deaths from Cholera in the Month of July during each of the Years 1867 to 1881 in the City of Bombay.

	Deaths.
July 1867	6
" 1868	3
" 1869	53
" 1870	2
" 1871	5
" 1872	46
" 1873	3
" 1874	3
" 1875	229
" 1876	212
" 1877	495
" 1878	156
" 1879	85
" 1880	1
" 1881	113

evidence divided between theory and fact will then stand thus. The *theory* is that one or more of the rice bags of the "Columbian" were tainted by cholera discharges at Bombay; that the germs of cholera were thus carried to Aden, and that these germs fastened on certain coolies who were employed in unloading the ship, and who were in consequence attacked by the disease. This is the theory; but the actual *facts* adduced are that the "Columbian" left Bombay when cholera was somewhat prevalent, and that a fortnight afterwards certain coolies out of those employed in unloading her at Aden were seized with cholera. These coolies were, so far as is known, the first persons attacked in the settlement. They had been employed in unloading the cargo of the "Columbian" immediately previous; therefore the unloading of the cargo was the cause of their being attacked. There is absolutely no other evidence in favour of the conclusion, except the coincidence in point of time, but there are many facts to show that to all appearance the coincidence was altogether one of time, and that the events do not stand to one another in the relation of cause and effect. Such is the opinion I formed after a careful perusal of the papers, but, in order that the matter might be looked at from independent points of view, I asked Dr. Lewis to read them over, and to let me know what he thought of them. This he has done, and his opinion is given in the Memorandum appended.* With all he has said I entirely agree. I have very little to add to it, but I may state very shortly why I do not agree in the conclusion that the outbreak of cholera at Aden in August to October last was due to the S.S. "Columbian."

1st.—Before even the vessel arrived, there was unusual sickness and mortality at Aden. True there was no cholera, and the unusual sickness and mortality were confined to a certain section of the community,—a number of starving Somalis, who had come from the African coast. It is worthy of notice, however, that the class of people among whom the largest number of cases of cholera afterwards occurred was also the Somalis. Of a total of 185 attacks in the whole settlement, 135 were among Somalis. The number of the population of each class is not given, and so it cannot be said in what proportion the different classes suffered: but there can be no question that the Somalis suffered severely, and that they had begun to suffer in a very unusual degree from sickness of one sort or other long before the "Columbian" arrived. The two facts are of importance.

2nd.—If it had been shown that unloading the "Columbian" was the only one condition common to the persons first attacked, a strong case would have been made out in favour of the committee's view But it is not so, for the coolies first attacked all lived in the same quarter, and some of those living there, who were attacked in the early days of the outbreak, had not been on the "Columbian" at all.

3rd.—There were, thus, at least two conditions common to the persons first attacked. The one was that they had been on board the "Columbian," and the other that they all resided at Steamer Point. Which of these conditions was most likely to have produced the disease? Certainly not having been on the "Columbian," for there was no such sickness on board that ship—there had been none previously; there was none at the time, and there was none afterwards. Much more probable it is that Steamer Point was the locality to blame. Here, as already pointed out, other cases of cholera followed among persons who had not been on the "Columbian." Moreover, the coolies first attacked were attacked so immediately after having been on the "Columbian," that the attacks seem hardly explicable on the "Columbian" theory. By the night of the very day she arrived one was dead. It seems also quite open to question whether this man, who formed the first fatal case in the settlement, had ever been on board the "Columbian" at all. The facts regarding him seem never to have been fully investigated, and he does not appear in the tabular statement of cases appended to the committee's report. All the information given concerning him is given in the following passage of the committee's report: "As it was reported that another coolie who had been employed "on board the S.S. 'Columbian" had died during the night, inquiries were at once instituted," &c. This fatal case should have been inquired into with the greatest care, and every detail regarding it most fully stated. Moreover, if the germs from the rice-bag or bags were so potent as to cause the death of at least one man within a few hours, how was it that, among some 700 people who lived continuously on board her for weeks, not a single person suffered from them? Much more probable it is then, that the cholera-producing causes were in Steamer Point, and not in the "Columbian."

4th.—Further, there is not the smallest evidence that the cases supposed to have been due to the "Columbian" formed the centre from which others arose. On this point the evidence is not so full as was desired; but two instances are mentioned, in which attacks are attributed to contagion. Three children of the hospital dresser were attacked, and the cases of the two last seized were attributed to their having been in company with the child first attacked. Without figures to show how many persons were attacked, out of those who attended or came otherwise in contact with the sick it is not possible to form any opinion in this case. If the attendants suffered more than other people, the result is altogether different from what has been experienced in India, where statistics collected now for some years conclusively show that attendants incur no greater risk than other people. The only other instance adduced of supposed communication from the sick to the healthy is contained in the Resident's letter dated 9th December. He says, "A man on his way from Aden to the "interior was seized at Imad with cholera, and on being taken into the mosque expired there: that "night nine persons died." Such instances at first sight have a terrible dread attached to them, and it is no wonder that the ignorant people among whom they occur are filled with alarm, and, in this state of alarm, conclude that the traveller was, beyond all doubt, the cause of the calamity which befell them. But a moment's reflection will show that the story carries its own refutation. It is beyond all the bounds of reason to believe that deaths from cholera could be caused within a few hours by a traveller who himself died of the disease about the very same time.

* *Vide* Appendix A. to this report.

5.—And lastly, is the conclusion of the committee in accordance with the experience of Aden? For many years the traffic with Bombay has been constant and enormous. There has been every facility for the carriage of germs and the development of cholera in the place, if cholera be due to such germs; but so far from having suffered often from cholera, Aden has been specially exempt, more exempt than almost any place that can be named in Europe or Asia, and yet Aden is but a few days' sail from Bombay. Experience, therefore, does not accord with the committee's views.

Small-pox.

The remarkable reduction in the mortality from small-pox, in the country as a whole, which was specially referred to in last year's report, is also manifest in the returns for 1881. There was some increase in Bengal, Assam, and in the North-Western Provinces and Oudh, as also in Mysore and Coorg. In Madras the ratio was the same as in the previous year, but in the Punjab, the Central Provinces, British Burma, and Bombay the death-rate from this cause was much lower than in 1880. As usual most of the deaths were among children under 12 years of age, and occurred during the first half of the year.

Fevers.

The death-rate from fevers during the year under review has everywhere been higher than it was during 1880, with the exceptions only of the Madras Presidency and British Burma. This increase was in part due to the disease in its various forms being more general over the country, and also in part to epidemics of exceptional severity, which were attended by immense loss of life in certain districts, such as in Nuddea in Bengal, the Terai districts of the North-Western Provinces, Amritsar in the Punjab, &c. In Burma and Madras the mortality was heavy during the first two months of the year, but in all the other provinces the deaths from fevers were most numerous during the last quarter. In all the provinces the bulk of the recorded mortality was attributed to fevers, but it is very certain that many deaths from unascertained causes are put down under this head. As regards the terrible mortality from fever in the Nuddea district, a Commission was, in November 1881, appointed by the Lieutenant-Governor of Bengal, as it seemed that the presence of malarial fever in severe epidemic form for two seasons in succession pointed to some local cause distinct from climatic influence, and Rs. 50,000 were placed at the disposal of the Commission to meet the cost of making such improvements as might be considered absolutely necessary. The Commission has reported that in some localities to the south of the district which suffered in 1880, the disease had subsided in 1881, though the subsidence of the fever "was not preceded or "accompanied by local alterations." The disease had, however, extended northwards and westwards, and it is estimated that during the year over 70,000 persons died of it. As regards the causation of the fever, the Commission is unable to offer any explanation. "We have," they say, "dwelt at length on the various insanitary conditions found in "the villages, and have no doubt as to their very injurious action upon the general "health of the people. How far they have caused, or even influenced, this outbreak of "fever is more a matter of medical science, than one to be decided by a mixed "Commission." Amongst some of the prominent insanitary conditions referred to, is the pollution of the water-supply in various ways, and notably by the bodies of the dead which are thrown into the rivers instead of being burned. Owing to scarcity of fuel in the district, cremation is beyond the means of the poorer portion of the population. As regards the frequently expressed opinion that the fever has been caused by embankments, &c., interfering with the natural drainage of the district, the Commission observe:—"In our opinion the outbreak of fever cannot be attributed to local "obstruction to drainage from want of water-way in roads or railways, nor can it be "shown that the silting up of old channels has been the immediate cause."

During the latter part of August, and during the months of September and October of the year under review, the inhabitants of the town of Amritsar in the Punjab suffered to a deplorable extent from a very fatal form of fever. It is estimated that, between the middle of August and the end of October, nearly 7,000 deaths occurred from the disease amongst a population of 149,000; that is to say, a mortality of about 47 per 1,000. It would appear that, although the population is composed of Hindus and Mahomedans in nearly equal proportion, the deaths amongst Mahomedans were not far from being twice as numerous as the deaths amongst Hindus. The Deputy Sanitary Commissioner, Dr. Bennett, who investigated the disease at the time, suggests that an explanation of this discrepancy in the death-rate of the two classes may be found in the fact that a large proportion of the Mahomedan population of the town was made up of poor, ill-fed, and badly-clad Kashmiris, among whom the disease was heaviest and committed its greatest ravages. It would appear that children suffered to an appalling extent. "It "would probably be no exaggeration to say," Dr. Bennett writes, "that two-thirds of "the infantile population have died since the commencement of the outbreak, and that

"the health of the remaining third have been so shattered that comparatively few, "among the poorer classes especially, are likely to survive beyond their fifth year." The sickness was, however, so universal, that it would appear that not a single European or Native escaped an attack. Nine-tenths of the shops are said to have been closed, and the work of Government offices was carried on with the utmost difficulty. To add to the general distress, cholera was likewise very prevalent amongst the people. Dr. Bennett states that two forms of fever were met with,—the ordinary intermittent and the rarer, but more dangerous, remittent form; but between these two extremes were many gradations, partaking of characters common to both. In its summary of the reports which had been furnished regarding the outbreak, the Government of the Punjab remarks that the mortality appears to have been mostly due to the saturation of the soil, resulting from unprecedented rainfall in a locality where the drainage was deficient, and where the system of conservancy was by no means perfect; and it has already issued orders that action may be taken to remedy these defects, so far as practicable, with the least possible delay.

Bowel complaints.

The mortality from bowel complaints during 1881 does not call for special remark.

Vaccination.

It was observed in last year's annual report that, with the exception of the Punjab, the amalgamation of the Vaccination with the Sanitary Department had been carried out, and that the reports on the vaccine operations of all the other provinces for 1880–81 recorded the results of the working of the department under the local Sanitary Commissioners. In October 1881 this arrangement was also adopted in the Punjab, so that the amalgamation of the two departments is now completed throughout the whole of British India. The present staff of vaccinators is being gradually instructed in the elements of sanitary science, and in some provinces a good deal of useful sanitary work has already been done by this establishment.

That the work of vaccination has not suffered under the new arrangements is evidenced by the immense increase in the number of operations performed throughout India, which will be manifest by a glance at the statistics of the year under report and the preceding year. This increase was not confined to any one province, but was manifested all over the country, except in Lower Bengal and Madras, where owing to adverse circumstances, there was a marked diminution in the number of vaccine operations. Omitting Mysore, the report for which province has not yet been received, the total number of operations in India rose from 4,181,722 in 1880–81 to 4,571,166 in 1881–82, and the ratios of success in most of the provinces were also in excess of those for the year previous. This will be specially referred to when reviewing the results of the working of the department in the individual provinces.

During 1881–82 the operations of the Vaccination Establishment were extended, for the first time, to seven Police Circles in Purneah, two in Maldah, three in Bhagalpur, five in Mymensingh, and to some outposts in Pooree. Besides these, six Police Circles of Purneah, a sub-division of Darjeeling, and the entire Sonthal Pergunnahs District were made over to the licensed vaccinators. The total number of operations for the year was only 1,349,607, against 1,394,312 in 1880–81. There was a considerable decrease in the number of vaccinations performed in the Metropolitan Circles, and in the Darjeeling, the Eastern Bengal and the Orissa Circles. This falling off is attributed to the paucity of unprotected subjects in certain areas which had been repeatedly gone over by the vaccinators in previous years, to great sickness among vaccinators in some circles, to the opposition of the natives to vaccination, and to other causes. The operations performed by the paid and licensed vaccinators in the different circles of the province amounted to 1,284,925. Of these 1,275,667 were primary vaccinations, with 1,258,576 successful cases, and 9,258 were re-vaccinations, with 3,695 successful cases. The percentages of success in primary and re-vaccinations were, respectively, 98·66 and 39·91. The average number operated on by each vaccinator was 1,229, against 1,256 in 1880–81. The number of successful operations among children between one and six years of age was 831,881. Besides these, 64,682 operations were performed by the vaccinators attached to the municipalities, dispensaries, &c. Of these 61,964 were primary cases, with the ratio of success at 92·99, and 2,718 were re-vaccinations, with the ratio of success at 54·59 per cent. The aggregate of the successful primary and re-vaccinations performed by the various establishments in the province was 1,321,377. Altogether, 773,331 operations were performed by the licensed vaccinators, against 802,545 in 1880–81. The total cost of the establishment was Rs. 1,17,118-12, and the average cost

of each successful case rose from Rs. 0-1-3 in 1880–81 to Rs. 0-1-6 in the year under report. In all 21,929 villages were inspected by the superintendents, deputy-superintendents and superintending vaccinators. The Compulsory Vaccination Act was in force in the towns of Calcutta, Rungpore, Rampore Beauleah, Soory, Hooghly and Chinsurah, Pubna and Bogra. The Local Government has sanctioned, as an experimental measure, the expenditure of Rs. 1,500 per annum to meet the cost of animal vaccination in Bengal, with a view to secure an efficient supply of animal lymph at the beginning of every vaccine season.

There are no dispensary vaccinations in the North-Western Provinces and Oudh, and the working of the special establishment was, apparently, restricted to children under six years of age. The total number of operations performed was 767,259, against 729,185 in 1880–81. This increase was due to the work being carried out on a larger scale in 28 out of 51 districts. In the other 23 districts the number of vaccinations was less than in the previous year, the decrease in some being very marked, as in Bareilly, Kumaon, Gonda and Ghazipur. The diminution in Kumaon, especially, where such satisfactory progress had been made in this direction, is greatly to be regretted; but it is stated by the Sanitary Commissioner that particular attention will be paid to vaccination in the Kumaon Hills during the current year. The number operated on by each vaccinator was 1,256 against 1,219 in the preceding year. Out of the total number of operations, 745,925 were primary and 21,334 were re-vaccinations. Of the former 684,026 were successful, the largest number ever attained since 1870, and of the latter only 3,890 cases. In primary cases the percentage of success rose from 90·57 in 1880–81 to 91·70 in 1881–82, and in re-vaccinations the ratio of success fell from 23·46 to 18·23. In all 15·59 per 1,000 of population were protected by vaccination during the year. During the year two additional native superintendents were added to the establishment, and the average number of vaccinators employed rose from 598 to 610. But there was a great reduction in the cost of the establishment, which fell from Rs. 1,29,319 in 1880–81 to Rs. 1,14,452 in 1881–82, and of this amount only Rs. 93,753 was paid by Government. The average cost of each successful case fell from Rs. 0-3-2 in 1880–81 to Rs. 0-2-8 in 1881–82.

The Vaccination section of the Punjab Sanitary Report for 1881 refers only to the last nine months of the year, broken up into two distinct periods—the first embracing six months from April to September, during which the department was conducted under the old arrangements, and the second dealing with the last three months of the year when the new arrangements were brought into force. But with a view to preserve uniformity, and to secure facility of comparison with the statistics of previous years, the principal figures (showing the results of the working of the department in the entire province under the old as well as under the new arrangement) have been specially obtained from the local Sanitary Commissioner, and have been incorporated in the first six tables appended to this section. From these it would appear that the total number of operations performed by all the establishments throughout the province was 673,487 against 450,779 in 1880–81, which again was the highest number ever attained since the commencement of vaccination in the province. Out of these 663,294 were performed by the special establishment with 614,059 successful cases, and 10,193 by the dispensary establishment with 8,803 successful cases. The percentage of success in the operations performed by the special establishment was 95·0 in primary cases and 52·6 in re-vaccinations; and in the dispensary operations it was at the rate of 86·6 and 82·3 respectively. The average number vaccinated by each vaccinator was 2,034 against 2,618 in the year previous. The ratio of successful vaccinations per 1,000 of population was 35·62 against 21·41; and the percentage of estimated children born in the province, who were successfully vaccinated during 1881–82, was 55·9 against 43·0 in 1880–81. No information is available regarding the expenditure of the department during the year under report. By the new arrangements considerable additions have been made to the number of native superintendents and vaccinators, and it is expected that the working of the department in future years will show a marked improvement over the results hitherto obtained.

In the Central Provinces, also, there was a considerable increase in the amount of work done by the vaccination staff as compared with previous years. The total number of operations performed by the special establishment was 369,651, of which 361,310 were primary and 8,341 re-vaccinations. Of the primary vaccinations 152,554 were successful among children under one year; 161,696 among children over one and under six years; and 33,120 among persons of six years of age and upwards. The percentage of success amongst these was 96·14. Of the re-vaccinations 5,640 were successful, or at the rate of 67·61 per cent. The number of vaccinations carried on by the dispensary

establishment amounted to 27,134, of which 24,288 were successful in primary cases and 820 in re-vaccinations. The total number of operations performed by the special and dispensary establishments combined equalled 396,782 against 325,021 in 1880–81. Of these 378,118 cases proved successful, or a percentage of 95·2. The average number vaccinated by each vaccinator was 1,824 against 1,538 in the preceding year. During 1881–82, 47·64 per 1,000 of the population were successfully vaccinated, or 9·19 more than in 1880–81; and, estimating the annual births of these provinces at 40 per 1,000, the percentage of infants vaccinated in the first year of their birth was 56·6 against 49·66 in the year previous. The total cost of the establishment was Rs. 39,102, and the average cost of each successful case was Rs. 0-1-9¼ against Rs. 0-2-1¼ in 1880–81. It is satisfactory to find that the opposition of the people to vaccination in these provinces is becoming less year by year. A special class was opened in the Nagpur Medical School for imparting instruction in the elements of hygiene to the vaccinators, and some progress was made during the year in this respect. A considerable amount of sanitary inspection work was also done by the vaccinators.

There were no changes of any importance in the vaccination establishment of the province of Berar during 1881–82. The work was carried on by means of animal lymph, supplies of which were received from Bombay, and also raised locally by the superintendents in each district. The attitude of the people in this province towards vaccination continues unfavourable, nevertheless there was a considerable increase in the number of operations performed during the year. These amounted to 95,420, or 9,621 more operations than in the year previous; and the total number of successful cases was 85,654 against 74,371 in 1880–81. Of the successful operations 50,357 were among infants under one year of age, and 33,693 among children of above one and under six years. The average number vaccinated by each vaccinator was 1,670 against 1,358 in the preceding year. In the operations performed by the special establishment, the percentage of success was at 89·8 in primary and at 63·0 in re-vaccinations. The ratio of successful vaccinations in the province per 1,000 of population was 30·8; and estimating the births of the year at 40 per 1,000, the ratio of those who were successfully vaccinated during the year was 47·8 per cent. Although there was some increase in the total expenditure of the year, the average cost of each successful case fell from Rs. 0-3-9 in 1880–81 to Rs. 0-3-5 in 1881–82. In this province also some useful work was done by the native superintendents of vaccination in the way of sanitary inspection of villages.

The Burmans have a great dislike to vaccination, and the defective nature of a portion of the lymph supplied in 1881, which proved an entire failure, will, it is feared, tend to check the progress of vaccination amongst them. Notwithstanding these drawbacks, it is satisfactory to find that the total number of operations performed in 1881–82 was 51,085 with 41,488 successful cases, against 46,912 with 35,296 successful cases in 1880–81. Excluding from this total 408 operations which were performed by medical subordinates attached to dispensaries, there were 48,142 primary and 2,535 re-vaccinations, with 82·85 and 50·25 percentages of success, respectively. This work was carried out by 48 vaccinators, under the supervision of 16 civil medical officers, who were also superintendents of vaccination circles, at a cost of Rs. 21,084, nearly one-third of which was defrayed by the Local Fund Committees and the Municipalities. The average cost of each successful case was Rs. 0-8-5, or 9 pie in excess of the cost per head in the year previous. The average number of persons vaccinated by each vaccinator was 1,056, which was made up of extremes varying from 382 at Akyab, where the people are stated to be extremely averse to vaccination, and where work had to be suspended for a part of the year for want of lymph, to 3,537 at Kyoukpyoo. It was only in six out of the 16 districts that the average number was above 1,000. The number of persons successfully protected by vaccination during the year under report was only 11 per 1,000. The number of successful operations among children under one year was 7,310, which is not even one-twentieth of the estimated births of the year.

The Vaccination Establishment in Assam has not yet been placed on a similar footing to that of the other provinces of the country. The imperfect means of communication in the province, the sparseness of the population in most of the rural circles, and the prejudices of the people are very serious obstacles to vaccination being generally adopted for some time to come. Notwithstanding these exceptional difficulties, the local authorities are doing all in their power to further its progress, and the Chief Commissioner has declared his readiness to grant funds, if assured that the additional expenditure would produce an adequate return in more and better work being done. Omitting 5,102 vaccinations performed by private practitioners in tea-gardens, the total number of operations carried on by the civil surgeons, hospital assistants, vaccinators, and

ex-inoculators amounted to 40,309, against 24,179 in 1880–81. Of these 39,128 were primary operations with 34,698 successful cases, and 1,181 were re-vaccinations with 1,118 successful cases. The percentages of success were respectively 88·67 and 94·66. In connexion with the large increase in the number of vaccinations, it should be noted that in 1881–82 the number of vaccinators employed was 36, and of ex-inoculators 96 against 17 and 58, respectively, in the previous year: 5,048 operations were verified personally by the civil surgeons during the year, and the proportion of success among these as ascertained by them was at the rate of 87·20 per cent.; 3·3 per cent. of the estimated births of the year were protected in 1881–82, against 2·8 in the year previous. Steps have lately been taken to check the work of the ex-inoculators.

The total number of operations performed in the Madras Presidency was 601,222 against 659,759 in 1880. Of these, 590,875 were vaccinated by the special establishment entertained for the purpose, and 10,347 by the medical subordinates attached to the dispensaries. Out of the former, 580,791 were primary cases, of which 529,959, or 91·2 per cent., were successful, and 10,084 were re-vaccinations, of which 6,640 or 65·8 were successful; and out of the latter, 9,890 were operated on for the first time, and 457 were re-vaccinations, yielding a percentage of 82·84 and 47·70 successful cases, respectively. The total number of successful operations among children under one year was 98,292 out of an aggregate of 731,866 births registered during the year, and among children above one year and under six years was 260,565. The average number of operations performed by each vaccinator during 1881 was 790, against 912 in the year previous, and the ratio of persons successfully vaccinated per 1,000 of population was 16·7, against 18 in 1880. In primary cases, a success of 92·6 per cent. is claimed by the rural circles and districts, but this high proportion seems open to suspicion when compared with the proportion attained in the municipalities, where the work is carried on under more efficient supervision. The results of 1881 show a marked falling off under several heads; but it would appear from the local report that this was mainly due to the backwardness of vaccination in the districts. In the municipal towns there was a marked improvement in 1881. The large decrease of 58,537 in 1881 is attributed to a great falling off in the number of vaccinations in the Tanjore district, where, as compared with 1880, the operations were less by 118,013. The history of vaccination in this collectorate for the past two years illustrates very forcibly to what extent success or failure may depend on the district officers. In 1880, the Collector, Mr. Webster, took active measures to improve vaccination, and he succeeded in increasing the number of operations by about 105,000. In 1881 his services were, by his transfer elsewhere, lost to the district, and the total number of vaccinations decreased by over 118,000; or, in other words, the number in 1881 dwindled down to 56,711, from 174,724 in 1880, and 67,254 in 1879. The explanation that there was a paucity of subjects in Tanjore in 1881, an immense number of children having been protected during the preceding year, is hardly sufficient, inasmuch as the total number of registered births in this district during the year was 59,770, whereas the number of infants successfully vaccinated was only 6,712.

The total outlay on the special establishment in the Presidency amounted to Rs. 1,56,655-15-10, and it is satisfactory to notice that out of this only Rs. 17,909-7-0 was contributed by the Government, the remainder being defrayed by Local Funds, Municipalities, and Native States. The average cost of each successful case was somewhat higher than in the preceding year, being Rs. 0-4-9 against Rs. 0-4-4 in 1880. Although the general results of the working of the department during the past year are not so satisfactory as could be desired, it must be borne in mind that in Madras the whole work is carried out by only one Deputy Sanitary Commissioner, assisted by a few native deputy inspectors of not very superior qualifications; whereas in Bombay and in the different provinces of the Bengal Presidency there are several European officers, and native officers of higher status, to personally direct and supervise the work in their respective circles.

Excluding secondary operations, the total number of vaccinations performed among the general population of the Bombay Presidency by the special establishment and by the medical subordinates attached to dispensaries was 778,737 with 739,235 successful cases against 695,237 with 655,115 successful cases in 1880–81. Out of this aggregate 749,429 were performed by the vaccine establishment with 675,260 successful primary operations and 37,215 successful re-vaccinations, and 29,308 by dispensary establishments, of which 25,050 were successful in primary cases and 1,710 in re-vaccinations. The percentage of success attained by the special establishment was 96·73 in primary and 72·52 in re-vaccinations, against 96·16 and 73·83, respectively in 1880–81; and the ratio of persons successfully vaccinated per 1,000 of population was 27·88, against

25·25 in the previous year. The average number operated on by each vaccinator was 1,751, against 1,569 in the preceding year. Only 460,623 infants were protected, which is less than one-half of the estimated total births of the year. The deaths from small-pox in this Presidency were very few compared with the two preceding years, and were restricted almost entirely to the two divisions of Sind and Konkan. It appears from the Vaccination Returns that, in the former, out of a total population of 2,542,976, only 112,795 were successfully vaccinated during the year, and in the Konkan only 76,637 out of a population of over three millions. The number of vaccinators employed in this Presidency was 428, or one more than in the preceding year, and the total cost of the establishment was Rs. 2,60,356. Out of this, the contribution by Government amounted to Rs. 1,13,995, or Rs. 19,120 in excess of the sum paid in 1880–81. The average cost of each successful case was Rs. 0-5-10, against six annas in the year previous. Vaccination was carried out throughout the Presidency from arm-to-arm, and with human lymph, except in the town of Bombay, where only animal lymph was kept up, and at Poona, where both animal and human lymph were in use. Animal vaccination was discontinued in Kurrachee, owing to the opposition offered by the Hindu community. The results of the operations carried on with the English lymph received during the year were not very satisfactory. In Bombay 434 heifers were inoculated, with unsuccessful results in 34 instances, and in Poona 35 out of 39 heifers were successfully inoculated. In Kurrachee the Vaccination Act (No. IV. of 1879) was in force throughout the year, and although the number of operations was less than in the preceding year, it is stated that there was great improvement in the quality of the work performed.

As already stated, the Vaccination Report of Mysore for 1881–82 has not yet been received. In Coorg the total number of vaccinations performed by the special establishment in 1881–82 was 4,887 against 3,808 in 1880–81. Of these, 4,693 were primary cases with 4,279 successful operations, and 194 were re-vaccinations with 125 successful cases. The number successfully vaccinated per 1,000 of population was 24·70; 498 operations were performed by the medical subordinates attached to dispensaries, out of which 392 were successful. The total cost of the establishment was only Rs. 1,174, and the average cost of each successful case was Rs. 0-4-3 against Rs. 0-5-7 in 1880.

Civil Sanitary Works.

Out of the total income of the Bengal municipalities, Rs. 6,68,157, or 23·93 per cent., were spent on sanitary works. Besides this, Rs. 4,51,993 were expended on the construction and maintenance of roads. Much was also spent on conservancy and drainage. Now that the municipalities are to be relieved of the heavy charges on account of the police, it is to be hoped a much larger proportion of their income will in future be devoted to strictly sanitary purposes. The following works were projected or undertaken during the year. The Eden canal project for supplying good water to Burdwan and Hooghly was completed in December. A scheme was matured for supplying the town of Burdwan with filtered water from the Damuda. The re-opening of the old Gangoor river in the Burdwan district was contemplated; if this project be carried out, a large tract of country will be drained and supplied with good water. Steps were being taken to extend the supply from the Dacca waterworks to the whole of that town. At Darjeeling the water-supply scheme was to be extended to the Bhutea Busti. A lake was constructed in the Govindpore sub-division of the Manbhoom district. A scheme for improving the *Sitakund* at Monghyr was submitted to Government for sanction. The Dinagepore drainage scheme was completed at a cost of Rs. 57,342. The drainage of the town of Rungpore was improved by the construction of surface drains. The Lalbagh drainage in Moorshedabad was being carried out. Great improvements were effected in the drainage of the towns of Darjeeling and Gya. A scheme for the special drainage of certain portions of the suburbs of Calcutta was under consideration, and considerable progress was reported to have taken place in otherwise improving their sanitary condition. Schemes are now under consideration for still further developing the water-supply arrangements for Calcutta; and the local Government has promised to give a grant of Rs. 1,70,000 in aid of a measure for supplying the suburbs also, on condition that the work is to begin by the 1st January 1883.

No sanitary work of magnitude was either executed or undertaken during the year in the North-Western Provinces and Oudh. In the municipalities much good work of a minor character was effected as regards the construction of new drains and latrines, paving roads, filling in excavations, providing sources of pure water-supply, &c. At Cawnpore 13,509 feet of the new drainage system was constructed during the year. The insanitary condition of villages was also receiving attention in several districts; 30 villages in Baharaich and 65 in Jalaun were brought under rural sanitation rules somewhat

similar to those in force in the Banda district, and to which reference has been made in previous annual reports.

In the municipalities of the Punjab a sum of Rs. 9,09,637, or somewhat more than one-fourth of their total income, was expended on sanitary works, excluding vaccination, during the year under report. Of this amount, Rs. 2,23,801 were spent on roads and bridges, Rs. 88,865 on drainage and sewerage, and Rs. 85,629 on water supply, including the clearing and repairing of tanks, wells, &c. The chief sanitary event of the year in the province was the completion of the Lahore waterworks, from which an abundant supply of pure water for the use of the city and the suburbs is obtained. Plans and estimates for the water-supply and drainage works at Delhi have been completed, and some preliminary works have been commenced. In Ludhiana special measures have been taken to protect the water-supply of the town and the district from contamination. A scheme for supplying Rawalpindi with pure water, which was commenced in 1880, was about to be proceeded with. In the city of Peshawar a considerable sum has been spent in constructing masonry channels for sewage and for drinking water. At Delhi the old drains have been cleaned and opened up. At Lahore the drainage works are progressing satisfactorily. At Amritsar the main drainage scheme is nearly completed round the eastern side of the city, and the internal drainage has been improved by the adjustment of the street drains with the outer main drain. The subject of the drainage of the whole locality, with a view of obviating the swamping and water-logging of the soil has been taken up, and surveys have been made. In the Hoshiarpur district three drainage schemes have been carried out. In Jullundur much has been done to prevent the swamping of the land round the city during the rains, and a project for flushing the main drains of the city is in progress. In connexion with the waterworks at Simla, orders have recently been issued to construct the Sanjauli reservoir.

In the Central Provinces an extensive scheme for supplying the city and station of Jubbulpore with pure water at an estimated cost of six lacs of rupees was commenced during the year, and the works were being actively carried on. The Hinganghat waterworks, referred to in the last annual report, were fast approaching completion. Tanks were cleared and deepened at Damoh and Raipur. Rs. 1,611 were spent by the Saugor municipality on the Kunera waterworks. In many of the districts the sources of water-supply were improved, and drains were constructed; 353 wells were repaired, and 191 new ones were constructed. Out of a total income of Rs. 5,22,145, the municipalities spent Rs. 1,23,383 on their conservancy arrangements.

No work of any magnitude was executed or undertaken during the year under review in Berar. In the five municipalities of the province, Rs. 25,864 were spent on purely sanitary works, including conservancy drainage and water-supply. In the districts the total outlay on minor sanitary works amounted to Rs. 89,027. The Akhatwara tank was constructed by the Public Works Department at a cost of Rs. 3,656. Schemes for supplying Khamgaon with pure water-supply and draining the town were under consideration. Projects were in hand for a system of tanks in the Amraoti hills and in the valleys of the Melghat.

Nothing of any importance was executed during 1881 in Assam. The municipal reports of the province, with the exception of those for Gauhati and Sylhet, which have not been received, show that in all Rs. 37,694-11-10 were spent on sanitary improvements. Out of this sum Rs. 5,833-9-5 were expended on drainage, Rs. 1,663-10-10 on water-supply, Rs. 8,544-10-1 on conservancy, Rs. 17,788-13-0 on the construction of roads and culverts, and the balance on the improvement of village sites, &c. At Shillong the new system of water-supply which was extended in 1880 to the suburb of the Maokar village was further extended during the past year, so as to embrace the police bazar, the regimental lines and hospital, and the regimental bazar. A project for keeping out the floods of the Brahmaputra from the town of Goalpara has been sanctioned. A scheme for the water-supply of Gauhati is under consideration. At Nowgong Rs. 2,888-6-8 were spent on drainage and conservancy.

Many sanitary improvements were effected in several of the municipalities of British Burma. In Rangoon the waterworks for supplying the whole town and the shipping with pure water were being vigorously carried out, and the drainage was greatly improved, upwards of Rs. 50,000 having been devoted to this purpose. At Prome a project for completely draining the town was sanctioned, and the works were in progress; several public latrines were erected; a scheme for the water-supply of the town was under consideration, and efforts were being made to abolish gradually the cess-pit system. At Bassein 7,000 feet of masonry drains were constructed; a great part of the Athegyee swamp was reclaimed; additional public latrines were erected; the cess-pits were being

rapidly replaced by proper drains; and a scheme for supplying the town with pure water was being considered. In Toungoo Rs. 23,205 were expended on sanitary works by the municipality; masonry drains were being provided throughout the town and many wells were improved. In Henzada Rs. 97,000 were spent on sanitary works, the most important of which was the construction of masonry drains.

No work of any magnitude was undertaken or executed during the year in the municipalities or local fund circles of the Madras Presidency. The total estimated income of the municipalities for 1881–82, was Rs. 14,73,234. Out of this, Rs. 4,56,766 were allotted to sanitary purposes, but, as in the preceding year, the whole amount was not spent. Rs. 2,44,446 were spent on conservancy arrangements for the towns; Rs. 32,065 were laid out on improving town sites; Rs. 19,263 in improving the water-supply; Rs. 2,434 in making sanitary arrangements during fairs and festivals; Rs. 17,507 on the construction and repair of markets and slaughter-houses; and Rs. 36,486 on miscellaneous sanitary objects, such as the construction and repair of latrines, drains, dust-bins, &c. The total available income of the local fund circles for 1881–82 amounted to Rs. 13,51,399, of which Rs. 3,86,959 were assigned to sanitary purposes; but in no circle was the amount allotted fully utilised. The works consisted, in most of the circles, of the sinking and cleansing of wells, the digging of tanks, the construction of latrines, &c., and in improving village sites.

The latest municipal reports summarised by the Sanitary Commissioner of Bombay refer to 1880–81. The total income of the municipalities during that annual period amounted to Rs. 25,69,791, and out of this Rs. 6,33,713 were expended on conservancy arrangements. At Ahmedabad City, Rs. 26,752 were spent on new works of a sanitary nature and on repairing roads, drains, wells, &c. In the city of Broach, Rs. 20,782 were devoted to similar purposes. At Tanna a considerable area of marshy ground was reclaimed; the plan and estimate for the Pokhran waterworks were sanctioned, and suitable sites were purchased for new markets. At Alibag a scheme was under consideration for bringing water by pipes from the Kainone spring; and some ground was specially prepared for the manufacture of poudrette. At Ahmednagar Rs. 7,148 were spent on drains, roads, water-pillars, &c. At Jalgaon water-pipes were laid from the town to the old village, and a drain and four public latrines were constructed. In the city of Poona Rs. 30,132 were spent on roads, new works in connexion with water-supply, new drains and sewers, and on new latrines. At Sholapur the construction of reservoirs and steam pumps and erection of special steam pumps for raising water were completed, and the work of laying out pipes and erecting stand posts were about to be finished. At Vengurla and Chiplun the head waterworks were repaired and improved at an aggregate outlay of Rs. 11,159. At Rajapur the waterworks channel was improved at a cost of Rs. 1,882. At Ratnagiri the water-supply works were completed and repaired at a cost of Rs. 15,131. At Kurrachee the waterworks were progressing steadily and were already to some extent utilised. Some important improvements were also carried out in the waterworks of the town of Bombay.

General Remarks.

Local self-government.

The system of local self-government which has lately been inaugurated, and which is being generally introduced in all the Provinces of British India, cannot fail to have a decided influence on sanitary progress. The "Central Provinces Local Self-Government Bill" is now before the Legislature. It is intended to deal with the whole province, excepting the municipalities for which suitable provision has already been made. It proposes the formation of local administrative areas by the aggregation of villages in circles and groups for purposes of local self-government, the establishment of local boards and district councils, and also the making over to the control and administration of these boards and councils, among other matters, "the construction and repair "of public wells, tanks, and waterworks, the supply of water from them and from "other sources, and the preservation from pollution of water for drinking and cooking "purposes," to which are added "any other local works or measures likely to promote "the health, comfort, or convenience of the public." By giving over these matters, which embrace the whole range of sanitary works and improvements, to local management, there can be little doubt that the residents, who are primarily to be benefited by these improvements, will take an interest in them and bestir themselves regarding them in a way which they have never done hitherto. At the same time all the advantages to be derived from the inspection and supervision of the officers of the Government will remain. Freed from police charges, which have hitherto swallowed up a great portion of the local funds, much larger sums will be available for sanitary purposes. The

principles embodied in this Bill are generally the principles which will be acted on in bringing the system of local self-government into play in all the other Local Governments and Administrations.

Village sanitation.

The sanitary objects which will claim the attention of the new boards may be said to be practically unlimited. In a Resolution recently issued by the Government of Bengal it is mentioned that one of the most important functions they could perform would be the gradual improvement of the drainage, sanitation and water-supply of villages. It is suggested that bye-laws should be framed and published after confirmation by the Government, and, as an illustration of how funds may be raised in some districts for such purposes, the Lieutenant-Governor cites a very interesting account given by Mr. Beames, the Commissioner of Burdwan :—

"In some parts of the Serampore sub-division there are very large and populous villages, among the inhabitants of which are many gentlemen of high intelligence and business habits. Some are retired officers of Government, others are pleaders and merchants, who go daily to their places of business in Calcutta. These gentlemen have undertaken the office of *Punchayet* under the Village Chowkidari Act, and finding a very great demand and necessity for sanitary improvements in their villages have availed themselves of the influence acquired by their appointment to induce the villagers to subscribe for such purposes. They have built culverts, made roads, and drained dirty places—all with funds freely contributed by the villagers. No possibility of oppression exists, as the villagers, from daily contact with the outer world, are far too well aware of their rights to permit themselves to be oppressed. Here and there a refractory villager refuses to subscribe, or cannot be induced to sacrifice some little corner of his holding for the purpose of making a drain, or refuses to put a stop to some nuisance which is offensive to his neighbours, on the ground that the *Punchayet* has no legal authority. The sub-divisional officer, Mr. Carstairs, has in all cases supported these enterprising *Punchayets* in every legal manner; but both he and they feel that some authority from Government is necessary to enable them to carry out the wishes of the majority. They do not wish to be made into municipalities or even unions, not being prepared to bear the burden or undergo the labour involved in maintaining municipal institutions. All that is necessary is that some addition should be made to the Village Chowkidari Act, or a chapter added to the Municipal Act."

This beginning, the Lieutenant-Governor remarks, modest though it is, promises good results, and the chapter of the law relating to this subject might legalize the levy of subscriptions for these purposes up to a fixed maximum.

Plague in Mesopotamia.

The special report on the outbreak of so-called plague in Mesopotamia in 1881 has been received, and contains some interesting particulars. Surgeon-Major Bowman, Residency Surgeon of Baghdad, writes :—

"As to the nature of the disease, from the statements of intelligent inhabitants of Nejef, and more especially those of the principal *mejtaheds* residing there and at Kerbella, the disease was a malignant, contagious, continued, fever, accompanied by an eruption of buboes on the cervical, axillary, or inguinal glands, or of carbuncles in the same regions, death occurring within a few hours, or about the fifth day; in children the mortality being extreme; also very high with adults. A previous attack was not any protection against a recurrence of the disease. I was unable to ascertain the period of incubation.

"The disease appeared, and was limited to the country situated within longitude 44° to 45° and latitude 31°, 25° to 32°, 30°, which is generally low-lying, flat and swampy, and during the spring of most years, inundated by the overflow of the River Euphrates. From the statements of residents, the disease first burst forth at Shinafiyeh, a large village situated at the south of the Sea of Nejef. (The inland lake called the Sea of Nejef was formed 60 years ago by an unusual high rise of the Euphrates, and is still supplied by a branch of the same river, in addition to some fresh springs at the north, and salt springs close to the Nejef shore. The length is 45 miles, and varies in breadth, being about eight miles across opposite Nejef. The water is brackish, but animals readily drink it. The shores are gradually shelving, but deep in the centre. Small boats navigate the lake.) The soil of the country is generally a rich alluvium, on which much rice is cultivated: but to the west is a flat, sandy desert. Nejef, where the disease was very fatal, is a large town with very high walls, containing about 13,000 inhabitants, a place of pilgrimage and of great sanctity to Sheeah Mahomedans, as the tomb of Ali is placed within its walls, and over a large tract of country outside the plain, presents the appearance of a vast cemetery, being the final burial place of numbers of Sheeah Mahomedans. The Shahs of Persia and other notables are buried inside the inclosure of the tomb of Ali. Nejef is situated upon the highest part of a plain, bounded on the south by what are called cliffs between it and the lake, on the other three sides by the plain, built upon limestone rock, and about 80 feet above the level of the surrounding country. The streets are very narrow, and encircle the tomb. The houses are small and confined, the entrance to many being below the level of the street. The rooms are small and very low; in the hot weather the inhabitants pass the day in deep *sardabs* excavated in the limestone, spending the night upon the roof. The thorough ventilation of the town is much impeded by the height of the city walls and narrowness of the streets; the gates of which there are two) are closed from sunset to sunrise. The sanitary state is highly defective, especially on occasions like the 11th of November, when 3,000 persons, in addition to the inhabitants, are stated to have attended the religious ceremony held on that date, all crowded into the town with

their numerous riding and baggage animals. The conservancy is nominally carried on by a municipality, but the arrangements for cleansing the town are of the most crude nature. In riding round and through the town on the 11th November, I remarked the open space between the city wall and the nearest house was used as a latrine; there are no public latrines, and very few houses have any arrangements for the reception of human excreta. Within and outside the town there is no vegetation of any kind, as the limestone rock is but scantily covered by a fine sand, apparently the detritus from the rock. Nejef is now supplied with excellent water by a cutting from the Hindiah Canal from the Euphrates, which was made by some benevolent Mahomedans (Indians and Persians) a few years ago. The termination of the canal is utilised to work some flour mills and water a garden on the shore of the lake. The profits from the mills are employed in keeping the cutting in repair."

As regards the alleged contagious character of the disease, this was generally believed in, and instances are adduced in support of this belief; but Dr. Bowman observes that "there are, in my opinion, no conclusive facts to prove that the disease was of a "contagious nature." Dr. Bowman himself visited the districts which suffered most severely, and was thus able to speak from information derived at the localities. He states that it is generally believed that "the disease, now called plague, is the same "disease that prevailed in Mesopotamia in 1876; but there is no evidence to show that "it ever appears in isolated places, though the virulence of the epidemic varies in "intensity in different places." As regards the land quarantine measures which were resorted to, the reporter is unable to state how far they proved efficient in preventing inter-communication between the different localities, and adds: "I have been repeatedly "informed that intercourse was kept up, and all the regulations evaded." There was no evidence whatever adduced to show that this disease had been witnessed on board any ships which had called at ports in the Persian Gulf, or that it had been brought by the ships to ports outside the Gulf. In this respect the experience of the present outbreak was but a repetition of the experience acquired when the disease was so prevalent in Mesopotamia during 1876. The disease was purely local in its character, and it may therefore be inferred that it was due to local causes. In a practical point of view, there is no evidence to show that the restrictive measures adopted, either by land or sea, were in any way to be credited with keeping the disease within its local limits.

Quarantine regulations.

Quarantine regulations were enforced at the ports of Kurrachee, Bombay, and Aden during the earlier half of 1881 against the supposed plague in Mesopotamia. One of the most prominent features in the sanitary history of the year under review, as well as of the current year, has been the persistent efforts which have been made by the International Board of Health at Constantinople to place Indian ports in quarantine. Such restrictions have been imposed at Suez on account of cholera, notwithstanding that special measures had been adopted at all Indian ports in order to satisfy the International Board. Quarantine has also been instituted at Brindisi and other Mediterranean ports, and, for a time, in order to save more serious complications, it was actually necessary to impose a quarantine on ships coming to India from Sumatra and Java, as, otherwise, Indian ports would have been compromised, and ships leaving them for the Red Sea would have been refused *pratique* at Suez. Such action at any Indian port would be extraordinary; but to demand a quarantine at Calcutta in order to preserve that port from contamination by cholera from Sumatra and Java, or any other place, is the most extraordinary demand that well could have been made by any sanitary authority. Calcutta always has, and, so far as is known, always has had cholera more or less; and so well is this known that the portion of Bengal in which it is situate has been regarded and pointed to by the various International Sanitary Conferences as the *home* of cholera. All these quarantine restrictions have caused grave interference with trade, and serious inconvenience to passengers. The question is still under discussion, and, so far, the International Board has declined to abate its action. The position which the Government of India has taken is that this is a matter which should be regulated, not by theory, but by practical experience. If the theories of contagious germs were correct, then it might be expected that ships would prove the means of conveying them from one country to another, but the Government have nothing to do with such theories. The only question they have to deal with is whether the public health has suffered from free communication, and if so, how this danger may best be met. But as a matter of fact there is no evidence of such danger. The danger of cholera being imported by ships into Europe through Egypt seems to be, at least to a large extent, imaginary. During all the years that India has been in constant communication with Egypt, there has been no instance of any such importation. The only instance in which a serious attempt has been made to show that such had been the case—the alleged transference of the disease from Bombay to Aden in the S.S. "Columbian"—has already been fully disposed of and need not be referred to further.

From the facts collected by Mr. Netten Radcliffe* we learn that, between 1865 and 1880, cholera has been present in one or other part of Europe in ten out of these 16 years, but in no case did it appear along the Red Sea route. If, then, cholera in Europe has been due to importation from India, the importation must have taken place by land and not by sea.

The restrictions which have recently been imposed by the Constantinople authorities on the pilgrim traffic between this country and Jeddah also deserve mention. The most important of these are the necessity for pilgrims to the Hedjaz providing themselves with passports, and the imposition of quarantine on all pilgrim ships at the Island of Camaran in the Red Sea, even when they are provided with perfectly clean bills of health, and have had no suspicious cases on board. The provision of passports, though vexatious to the pilgrims, may be productive, indirectly, of some good, but the orders enforced by the Turkish Government as to quarantining all pilgrims at Camaran, may be productive of great hardship, and there is reason to fear that they have already proved so. It is to be hoped that the recent appointment of a Mahomedan medical gentleman as Vice-Consul at Jeddah may in some measure mitigate the hardships which Indian pilgrims have to undergo, by giving them the opportunity of appealing to a fellow-countryman and a co-religionist for assistance.

"Vital statistics of India."

The issue of a volume of the "Vital Statistics of India" deserves to be mentioned. It embraces the statistics of sickness and mortality in the European army of the three Presidencies during the ten years 1870-79. It was commenced by the late Surgeon-Major J. L. Bryden, in continuation of a similar volume dealing with the European troops of the Bengal Presidency for the ten years 1860-69, and has been completed by his successor in the Statistical Office, Surgeon-Major A. Stephen. Frequent reference has already been made to the figures it contains in the section of the report which deals with the European army.

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* Report of Medical Officer of the Privy Council, Series V., 1875. Report by Mr. Netten Radcliffe in Transactions of the Epidemiological Society, Vol. IV., Part IV., 1882.

134534

ABSTRACT OF REPORT OF THE SANITARY COMMISSIONER FOR MADRAS FOR 1881.

(Dr. M. C. Furnell).

European Troops.

Sickness and mortality among European troops.

On the 1st January 1881 the strength of British troops borne upon the rolls of the Madras Army was 10,349, and on the 1st January 1882, 10,521, showing an increase of 172. The admissions into hospital were 1,164·8, which is a less admission than 1880. The mortality was slightly higher, but is a more favourable death return, excepting 1880, that we have for the past 20 years.

The subjoined table gives the ratio of admissions, daily sick, mortality, and invaliding since 1870:—

Years.	Admitted.	Daily Sick.	Died in and out of Hospital.	Invalided.	
				Change of Climate.	For Discharge.
1870	1,481·5	63·6	19·7	70·4	6·6
1871	1,211·5	56·2	19·1	29·7	12·5
1872	1,352·3	59·7	19·2	26·8	11·2
1873	1,270·8	59·3	18·5	50·6	12·7
1874	1,141·2	57·6	13·4	29·5	8·3
1875	1,096·3	56·9	14·8	60·8	15·5
1876	1,132·9	55·2	16·1	31·9	10·9
1877	1,172·2	58·7	17·2	36·0	10·2
1878	1,379·7	65·8	22·1	36·6	9·1
1879	1,488·7	68·4	16·8	34·3	10·2
1880	1,385·4	68·4	9·9	15·0	8·0
1881	1,164·8	68·2	11·1	No return received.	

During the year there were eight cases of small-pox, all at Bangalore, one of which proved fatal.

The admissions and deaths from fevers this year compare favourably with the last preceding three years. There were 2,880 admissions, of which seven died; last year the admissions were 4,621, of which 16 proved fatal. By far the largest number of entries is, as usual, under the head of intermittent fevers; out of the total, 2,880 no less than 2,100 were from this cause, but none proved fatal. Continued and remittent fevers together numbered only 771 cases, of which two proved fatal. Last year there were 1,196, of which five died. By far the largest number of cases of continued fever are from Thayetmyo, which last year also was noticeable for the same fact, whilst Bellary has none and Secunderabad only 22 cases. These stations last year were bracketed with Thayetmyo.

This year there are only nine entries under typhoid fever, of which five proved fatal. I commented in last (and the year before) annual report upon the unreliability of these entries. On reading over the abstract of cases, it is very evident that the entry to typhoid fever is only made when a case of continued fever assumes grave symptoms, whilst in some *post mortem* notes of fatal cases entered under remittent fever we find such notes as the following: "There were large patches of ulceration about 2 inches in length "by one in breadth. In the lower part of the ileum the glands were swollen and raised "above the surface and presented a blackened appearance, &c." However, it is satisfactory to note that under all three heads—remittent, typhoid, and continued fevers—the entries are considerably less this year than last.

There were 35 cases of epidemic cholera during the latter part of the year—25 in Kamptee, three in Secunderabad, and seven in Thayetmyo. Last year not a single case occurred amongst Her Majesty's troops serving in Southern India.

The number of admissions and deaths from sunstroke and apoplexy compares favourably with the past year—28 admissions and seven deaths. This year there were only

two admissions and no deaths in Kamptee as against 19 admissions and two deaths in 1880.

As usual there is a large entry under hepatic diseases—403 admissions with 16 deaths—but this compares favourably with the preceding two years. Last year there were 457 admissions with 15 deaths.

The admissions under venereal diseases, although very great during the past year, viz. 2,257, compares favourably with past years. Madras, as usual, exhibits a very high ratio.

Native Troops.

Sickness & mortality among Native troops.

The strength of the Madras Native Army on January 1st, 1881, was 30,763. During the year there was a decrease by invaliding, desertions, deaths, &c., of 2,485, and an increase by recruiting, transfers, &c., of 2,040, leaving a total of 30,318 present on January 1st, 1882. Of these we have the medical returns only of 23,314 furnished to this office; the remaining 7,004, it is presumed, are serving outside the limits of the Madras command. Of this number (23,314) there were 22,119 admissions into hospital and 380 deaths, giving a ratio of deaths per 1,000 of 16·2. The deaths amongst the civil population during the same period was 16·2 per 1,000; in England it is 18·6.

Below is given a table which shows at a glance these facts contrasted with those of the previous 13 years. From this table it will be seen that, although the number of admissions into hospital is somewhat less, the deaths and invaliding are higher. This, no doubt, is a legacy of the Afghan and Rampa disturbances of the previous year, added to some cases of cholera which occurred at Kamptee and Trichinopoly :—

	Ratio per 1,000 of Strength.													
	1868.	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	1880.	1881.
Admissions - -	707·4	702·5	630·6	663·9	1,007·2	885·2	772·7	777·7	720·8	832·2	793·2	1,001·2	1,275·9	948·7
Daily sick - -	29·0	29·3	26·4	26·9	34·7	31·3	26·6	30·7	28·2	28·3	29·7	40·4	55·8	44·6
Deaths in hospital. -	8·6	10·1	9·4	8·8	9·9	6·4	7·7	9·0	9·8	11·3	11·7	11·8	12·3	13·2
Deaths out of hospital -	1·4	3·6	3·6	1·8	2·4	1·8	2·0	1·5	1·2	1·7	1·6	2·5	2·4	3·0
Invaliding - -	16·4	24·5	25·6	23·3	28·4	30·8	33·5	39·3	37·1	30·5	52·6	38·9	31·8	47·0

The greatest number of sick, as usual, come under the heads of fevers, bowel-complaints, and skin diseases. But this year rheumatism swells the return with 951 admissions and cholera 75 cases.

There were 8,673 admissions with 38 deaths from intermittent fever, which is an improvement on last year; Bellary, Secunderabad, Kamptee, and Rangoon returning the most numbers, Rangoon having by far the greatest number of deaths.

Of cholera there were 75 admissions with 31 deaths. Of these Kamptee had 24 admissions with six deaths, and Trichinopoly 39 admissions with 18 deaths.

There were 33 admissions with three deaths under small-pox. Last year there were 23 with two deaths.

Jails.

Sickness and mortality in jails.

From the medical returns furnished to this office the average strength of the jails during 1881 was 10,322, of whom 7,664 were admitted into hospital and 428 died, being 5·5 deaths per cent. of admissions about the same, but slightly higher than last year.

Of the 7,664 admissions into hospital no less than 2,645 were under the head of fever, 2,379 being intermittent fevers; of these Rajahmundry central jail alone gives more than one-half (1,315). Dysentery and diarrhœa are responsible for 1,277 of the remaining cases, and there are 90 admissions under cholera.

The immunity from cholera enjoyed by the jails during 1880 was unfortunately broken during 1881. The epidemic which swept over Southern India at the end of the year, and which is still existing whilst I write, visited the central and district jails of Trichinopoly. Of the 90 cases of cholera borne on the year's return no less than 88 took place in these two jails, 4 in the district and 84 in the central jails, and they are answerable for the whole of the 33 deaths recorded from this cause. I visited the Trichinopoly jail in March 1881 and can quite bear out the remarks of the Superintendent in his annual report to this office, viz., "the jail is scrupulously clean in every respect," and that "the water-supply is good, water clean, soft and pure, and free from salines." The food is reported to be strictly according to the scale laid down in the regulations.

The Medical Officer in charge thus reports: "Cholera was prevalent in the town twenty days previous to its outbreak in the central jail, and it was probably communi-
" cated by contractors, servants, warders, and policemen coming into the jail from the
" town." The Inspector-General of Jails, Colonel Tennant, considers this supposition quite untenable, and points to the fact that "the first prisoner attacked was a Burman

" who had never been outside the jail walls since his admission. This prisoner slept " in No. 5 block and worked in No. 4, and it so happened that this particular Burmese " prisoner did not come in contact with the persons mentioned in Surgeon-Major " Thomas' letter as being likely people to communicate the disease." The evidence on which this latter statement is made is not however given.

Colonel Tennant seems inclined to attribute the outbreak to the position of the municipal filth depôt in regard to the central jail. "Whilst at Trichinopoly," he writes, "I visited the muncipal filth depôt. It was evident that the filth had been " thrown on the ground and left seathing in the sun and not covered up in pits; the smell " was something frightful, and the filth lay exposed although endeavours had recently " been made to cover it over with earth. When cholera was prevalent in the town it is " but reasonable to infer that choleraic discharges were carted away with the filth and " thrown on the ground at the depôt. The wind blew from the direction of the filth " depôt towards the market place, and I understand that cholera was very bad in that part " of the town. Mr. Johnston informs me that about the middle of November the wind " changed and blew directly over from the depôt to the central jail. The distance, as " the crow flies, from the filth depôt to the central jail, I should say, is a little over a " mile, and it may be a question for sanitary consideration whether this may not have been " the cause of the outbreak of cholera in the central jail at Trichinopoly." I think this theory is well worthy of consideration.

The Medical Officer having furnished me with a copy of his letter, I ventured to address the following recommendation to the Inspector-General of Jails: "Whether it " would not be politic, when cholera is present in any town where a central or district " jail is situated, to issue an order compelling all warders, policemen, contractors, " servants, &c., having access to the said jail to report immediately any cases of cholera " occurring in their houses or immediate vicinity of their residences, so that precautions " might be taken to prevent their mixing with the prisoners." To this I received no reply.

As a practical medical man I should feel inclined in a case like Trichinopoly, having in view that our knowledge of how cholera is spread is but conjectural, to adopt both precautions. Have the filth depôt, if possible, removed to a greater distance, at any rate properly covered and looked after; and forbid, if possible, the warders and other attendants, during the continuance of the epidemic, sleeping in or visiting the town which is two or three miles distant.

Small-pox occurred in four jails only. There were six cases altogether and only one death, which is even a more favourable state of things than last year.

There were only 1,277 cases returned this year as against 1,479 last year and 2,111 in 1879. The percentage of deaths to admissions under this head is still very high, 12·7. The percentage of deaths to admissions is as follows in the jails which show the highest deaths from dysentery and diarrhœa:—

	Per cent.
Trichinopoly Central - - -	24·2
do. District - - -	46·2
Cannanore - - -	31·9
Rajahmundry Central - - -	14·3

In G.O., Nos 1361 and 1362 of 6th October 1881, attention is drawn in the despatch of the Most Honourable the Secretary of State for India to the excessive mortality in the Coimbatore and Tanjore jails which points, according to the opinion of the Army Sanitary Commission, to something radically wrong. In a subsequent despatch the mortality in certain jails is described as still excessive and demanding inquiry.

In obedience to the above G.O. I visited the Coimbatore jail, and I herewith subjoin the substance of the report I made to Government on the matter:—

"The subject has been so fully gone into by the Inspector-General of Jails in his letter No. 163, dated 29th August 1881, that it seems needless to repeat the arguments he adduces in explanation of this apparent excessive mortality, due evidently to the exceptional years. Confining myself, therefore, simply to my inspection, I have to report that I carefully went over the Coimbatore jail on two successive mornings with the Medical Officer and Superintendent examining the prisoners, their clothing, food, water-supply, dormitories, latrines, &c. I found the whole body in admirable health, strong and well able to do the work allotted to them; no trace of anæmia or scurvy. There were 1,027 prisoners in the central and 133 in the district jail = 1,160; total sick 13, a little more than one per cent. Of these sick only two were seriously so. The only suggestion I was able to make was some alteration in the filtering arrangements of the drinking water which the Superintendent promised to attend to."

The Tanjore jail, which stands highest in relative mortality this year, giving a death-rate of 165·5 per 1,000, has long been condemned and should be abandoned.

General Population.

As remarked in last year's report, no change has taken place in the mode or machinery of registering births and deaths. The returns can, therefore, only be looked upon as approximative; and, until some simple legal measure is passed defining the duties of village accountants, and making the duty of reporting births and deaths to that official compulsory on every householder, they must continue to remain so. Vital statistics.

The total births registered were 731,866, giving a ratio of 25·5 per 1,000, the largest number of births and the highest ratio for the past 12 years. This means, most probably, that not only were there more births, but that the registration, imperfect as it is, is on the whole improving. Of the 731,866 births, 375,816 were males and 356,050 females, being a proportion of 105·7 males born for every 100 females. This is much the proportion that the past year's registration has shown.

There were registered 465,682 deaths during 1881, being an increase over those of 1880. The death ratio per 1,000 was 16·2 as compared with 15·7 in 1880. This is a slight increase over 1880, but is less than any of the 11 years previous. If the returns were from a reliable registration it would point, as remarked last year, to a death-rate less than in great Britain. It cannot, however, be so taken, and the only safe conclusion is that, compared with the past 12 years, 1881 was a favourable year in a sanitary point of view.

Of the deaths registered, 239,494 were males and 226,188 females, showing a preponderance of death amongst males in the proportion of 105·8 to 100. Last year it was Tanjore and Trichinopoly which showed a preponderance of female over male deaths; this year the districts of Tanjore, Madras, Cuddapah, and North Arcot have that distinction. But Tanjore heads the list very markedly, there having died in that district 24,141 females to 23,820 males.

The death-rates in towns was 22·8 per 1,000, which is a slight increase over last year, when it was 21·8 per 1000, but it still compares favourably with the average for five years before the famine, 26·6. The death-rate in the rural population was 15·2 per 1,000, which also is an increase over 1880 (15·4), but it compares favourably with the average, 21·1 per 1,000.

The singular immunity from death which characterised the Native Christians of Ganjam and Madura during the previous two years would seem to have passed away; still the mortality is very low. In Ganjam, out of a population of 645, three only died, which represents a ratio of 4·6 per 1,000; in Madura it was slightly higher. Taken altogether, however, the mortality amongst Native Christians throughout the Presidency is apparently higher than amongst Mahomedans and Hindus. Native Christians 19·2, Mahomedans 15·8, Hindus 16·2 per 1,000.

The following return gives the deaths from different causes during the year under review. It will be seen that, although not so good a year as 1880, it still is better than any of its predecessors, until we go back to 1871. The increase in the year is due almost entirely to deaths from cholera, of which there were 9,446 as compared with 613 of the previous year. Fevers and bowel-complaints were not quite so high as last year:—

Years.	Total Deaths.	Cholera.	Small-pox.	Fevers.	Bowel Complaints.	Injuries.	Other Causes.
1866	600,106	206,961	23,106	110,102	—	9,047	256,890
1867	372,026	33,205	27,907	112,511	—	8,613	189,790
1868	390,959	8,036	34,330	105,692	—	9,242	233,659
1869	451,981	21,034	17,448	132,348	—	9,310	271,843
1870	451,020	55,867	11,252	151,027	—	12,325	220,549
1871	444,371	17,656	20,823	192,469	38,928	15,323	159,172
1872	501,482	13,247	39,074	214,148	39,387	15,150	180,476
1873	506,894	840	51,784	222,843	36,392	14,251	180,784
1874	516,848	313	48,343	226,220	37,993	13,065	190,914
1875	641,260	94,546	24,775	252,042	37,484	12,421	219,992
1876	680,384	148,193	23,469	230,092	38,176	11,175	229.279
1877	1,556,312	357,430	88,321	469,241	133,366	16,460	491,494
1878	810,921	47,167	56,360	374,443	48,083	15,007	269,861
1879	549,390	13,296	17,840	285,477	23,218	12,619	196,940
1880	454,101	613	14,529	209,940	19,622	10,845	198,552
1881	465,682	9,446	15,776	203,542	18,961	11,527	206,430

Cholera.

The immunity from cholera, so characteristic of 1880, continued during the greater part of 1881, but during the last quarter this pestilence made its appearance in the southern part of the Presidency, carrying off 9,446 victims. Of these 2,220 were registered as having died in the towns and 7,226 in the districts. The Ganjam District, which returned almost all the deaths during 1880, returned only 159 this year, all of which cases occurred in the early months.

The disease was known to be prevalent in the adjoining part of the Presidency of Bombay, and, judging from past experience, it was expected to make its way down to Madras. In September 1881 the Surgeon-General sounded a key-note of warning, calling upon all Zillah and Civil Surgeons to be prepared for its advent, and shortly afterwards the Government published in the Gazette a similar warning to all Presidents of Municipal and Local Fund Boards from this office. The warnings were promptly acted on.

Small-pox.

In last year's report it was remarked that small-pox, like cholera, had been less fatal during the year under review; this year the exact converse is the case. Small-pox, like cholera, has been more fatal. There were 15,776 deaths registered under this head as against 14,529 during 1880; of these 8,063 were males and 7,713 females. As usual, Ganjam heads the list of mortality under this head, followed by Tinnevelly, North Arcot, Madras, and Chingleput. Last year the list was Ganjam, Tinnevelly, North Arcot, Chingleput, and Malabar—almost indentically the same.

In Ganjam, where I was on tour quite lately, I am given to understand inoculation is still largely practised in the more remote parts, which no doubt accounts for the unenviable pre-eminence this district enjoys from small-pox mortality.

Since 1879 attention has been drawn to the large proportion of deaths amongst children under 12 in the table of small-pox mortality. In 1879 about one-half were so returned; in 1880 considerably more than one-half—indeed nearly two-thirds of the deaths took place in children under 12. This year considerably more than two-thirds, viz., 11,202 deaths, out of a gross mortality of 15,776 registered in the districts, took place in young children.

In the annual reports of 1879 and 1880 the subject was fully entered upon, and it does not seem desirable to travel over the same ground again. I can only repeat the observation of last year, endorsed by Government in their Order No. 1423 of 20th October 1881: "The Sanitary Commissioner can but yearly draw attention to the "large mortality amongst children from small-pox, in the hope that it will in time be "recognised by Native gentlemen and others forming local fund and municipal bodies, "that in early vaccination lies the greatest protection not only to individuals, but to "communities."

Fevers.

Fevers form, as usual, by far the largest sum of mortality; out of a gross total of 465,682 deaths, 203,542 are returned as fevers. I confess myself at a loss to account for this persistent and ever increasing death-roll from fevers, unless it be the habit which obtains amongst the people all over the country of poisoning, by filthy practices, their water-supply, and their exposure by reason of their very scanty clothing to vicissitudes of temperature. But these are not new customs.

Bowel complaints.

There are fewer deaths returned under this head than last year or any previous year of which we have records. The probability is that many deaths which would have been returned under this head have been included under cholera. The number returned is 18,961, of which 10,023 were males and 8,938 females.

Vaccination.

The total numbers vaccinated during 1881 fall short of the numbers vaccinated during 1880 by 58,537. This is accounted for satisfactorily by the necessary decrease in Tanjore after the past year's efforts. The number in that collectorate alone show a decrease of 116,216, more than sufficient to account for the whole falling off. The numbers vaccinated during 1881, however, compare favourably with the numbers during any previous year omitting 1880. The percentage of successful vaccinations is even better than last year, which was an improvement on its predecessor; out of 590,681 primary vaccinations there were 538,152 successful, giving a percentage of 91·1 as against 88·72 in the previous year; and out of 10,541 re-vaccinations 6,858 were successful, being 65·06 per cent. against 50·42 in 1880.

Infantile vaccination seems to be slowly progressing, the number vaccinated in the districts under one year being 75,710; but this is still only 11·1 per cent. of the

registered birth-rate, probably not 8 per cent. of the actual births. Coimbatore takes the lead in infantile vaccination, 12,124 having been thus protected.

In the municipalities there was also a slight increase in infantile vaccination, but it is much below what it should be. In this respect Madras heads the list with 8,456, and Anakápalle, with a population of 13,044, returns only 5.

The average cost of each successful case is annas 4·9, which is a slight increase over last year of 5 pies per case. In the districts the cost varied from annas 14-1 in Cuddapah (Madanapalle Circle) to annas 2-4 in Coimbatore. In municipalities from Rs. 1-10-10 in Wálajápet to annas 1-9 in Máyaveram.

Dr. Price remarks: "In my opinion more inspectors and deputy inspectors are "required if the vaccination is to be first class and none other is thoroughly protective. "A deputy inspector ought to be able to see each vaccinator in his circle at least once "in every three months. (Some of the circles at present are so large as to render this "impossible.) The inspector ought to be able to visit each deputy at least once in "every six months. At present he is only expected to see each of them once in two "years, and even to do this he must run over them, there not being time to give each a "thorough inspection."

Sanitary Works.

From only 46 of the 48 municipal towns were sanitary reports received. Rajahmundry* and Coonoor furnished none. The sanitary works executed were of a nature similar to those carried out in former years. Details are given in the abstract of notes under this head for each municipality.

The total estimated income of all the towns, excluding Madras, amounted to Rs. 14,73,234, being an average of Rs. 1-3-4 per head of population. Of this amount Rs. 4,56,766 were sanctioned for sanitary purposes for the year 1881–82, or 31·0 per cent. of income. The allotment on the whole appears to be satisfactory; and even in individual towns there is nothing to complain of in regard to the provision made for sanitation, except in Calicut, Ongole, Mangalore, Chidambaram, Cocanada, Pálghat, Negapatam, and Palamcottah, in all of which the allotment was below 20 per cent. of income. But it is to be regretted that the whole sanctioned allotment has not been fully made use of: out of an aggregate allotment of Rs. 4,56,766 only Rs. 3,34,703 were spent, leaving Rs. 1,22,063 or a little more than one-fourth unutilised, and this difference is distributed among all the municipalities. In none was the full sanctioned sanitary allotment made use of except Tanjore, Máyaváram, and Negapatam which have exceeded their grants.

Sanitary reports were received from 31 Local Fund Circles, being less by one than those which furnished reports in 1880, as the two circles in the Malabar District, Calicut and Tellicherry, were amalgamated. Sanitary work consisted, as usual, in most of the circles, in the sinking of wells and excavating tanks, in the erection of latrines, dust-bins and cinerators, repairing and cleansing tanks and wells, removing rank vegetation, and improving village sites by the levelling and repairing of the streets, &c., and some other minor works. In some circles more works were carried out than in others. Coimbatore spent the most during the year, viz., Rs. 40,856 (including Rs. 8,203 for conservancy and Rs. 28,626 for the construction and repair of markets and slaughter-houses) in the execution of some sanitary work or another, while Canara spent the least, only Rs. 868.

The aggregate available income (*i.e.*, one-third of the land-cess) for the year 1881–82 amounted to Rs. 13,51,399; of this amount Rs. 3,86,959 were allotted and sanctioned for sanitary purposes. This sum does not include the allotment for the construction and repair of markets and slaughter-houses. The proportion it bears to available income is 28·7, being 4·6 per cent. in excess of the grant for the past year, 1880–81; it may, on the whole, be considered a fair allotment. Taking each individual circle too, the allotments appear to be fairly satisfactory. Eliminating Malabar, for reasons given in last year's report, in no circle is the grant less than 16 per cent., except Chatrapur, which has allotted only 11·9, and Bellary 8·7 per cent. Guntúr, Negapatam, Ellore, and Tanjore stand high up in the list with an allotment of 84·8, 68·6, 63·7, and 61·4 per cent. In the other circles the allotments varied from 43·1 per cent. in Kurnool to 8·7 in Bellary.

While the sanitary allotment taken collectively as a whole, or individually, except in a few circles, appears to be satisfactory, it is very much to be regretted that the

* Was received subsequently, but too late for incorporation in the report.

amount sanctioned has in no instance been fully utilised. In my last Sanitary Report for 1880, I pointed this out in certain instances for which I had information; and seeing this to be the case in some circles, I was induced to call for particulars from all of them, and the result shows that for 1880–81 and 1881–82 in no circle has the whole sanctioned sanitary grant been fully utilised. In 1880-81, out of an aggregate sanctioned allotment of Rs. 3,58,121, only Rs. 2,52,134 were spent, leaving little less than one-third unused. In 1881–82 it is still worse; out of an aggregate allotment of Rs. 3,86,959, which was sanctioned for sanitary purposes, only Rs. 2,01,546 were so used, leaving more than one-third unexpended. In some circles even more than one-half was not utilised.

General Remarks.

During the year under review I visited Coimbatore, Salem, Pálghat, and from thence all the municipal towns in the Western Coast as far as Mangalore, and subsequently the Northern Circars from Ganjam to Vizagapatam, returning to Madras at the end of March.

In my last annual report, I mentioned that the impression left on my mind from touring, was that the great needs in sanitation were (1) improved water conservancy (2) removal of filth from the interior and surroundings of houses. I must say my recent travels have but confirmed my first impression, only that I should feel inclined to put the first, viz., necessity of water conservancy, a long way before any other.

The people of India, and I am speaking of the multitude, the million, compare, I think, favourably as regards the interior of their houses with the multitude in European countries. I am, or was, as a doctor, well acquainted with the interior of the houses of the poorer classes of England, Wales, and some towns of France, and I must candidly say I have found less repulsive filth in the interior of the houses of the people of this country, especially in the mofussil, than amongst people of the same class in Europe. But the treatment that drinking water undergoes in this country is not only apalling, but perfectly inexplicable considering that it is so diametrically opposed to the commands laid down in their holy Vedas.

In the third or Yagur Veda, the part called Arana contains the following commandments:—"Do not spit out with retching in the water. Do not pass urine or discharge "excreta in the water. Do not drop blood into water. Do not throw any hair, or nails, "or bones or ashes, nor dip dirty clothes into water. For to do so is to abuse a "precious gift of the gods and disgrace them."

Ménu the Lawgiver, says:—"Let him not cast into the water either urine, or ordure, "nor saliva, nor cloth, nor any other thing soiled with impurity, nor blood, nor any "other kind of poison."

Nothing therefore can be plainer than the commands of their own lawgivers on this point, and yet from Cape Comorin to Cuttack, and from Madras to Mangalore, the whole length and breadth of our Presidency, and—from letters I have received from Bengal since I lectured on this matter at Patcheappah's Hall—most probably I might fairly say the whole length and breadth of India every tank and water-source is more or less defiled by "spitting with retching, passing urine and other excreta, and washing "filthy rags in the water."

In my report for 1880 I wrote: "I carefully watched at some tanks, for instance, at "Hosúr, Bellary, Máyavaram, &c., people washing their clothes and persons in tanks, "from which the women were taking home vessels laden with water for cooking and "drinking. This water, in one or two places, when examined, was found to give every "possible evidence of impurity, &c." I have continued this examination at every place I have visited and found the practice the same. It is not that the water contains a thousandth part more or less of a miligramme per litre of ammonia or any other objectionable salt, such as analytical chemists determine with so much nicety in Europe, it is that the water is to the naked eye and nose in almost every instance, a palpably unclean, offensive, dirty fluid, in which almost any amount of a solution of the permanganate of potash dropped in loses its colour. It would rank in Europe as simple sewage.

And less I should be deemed guilty of exaggeration, let me add a few notes of what I have seen in recent tours. In Coimbatore, situated in the middle of the town is a splendid well called Ananta Iyer's well. It must have cost a great deal of money to construct and is really a magnificent well, giving an abundance of clean, sparkling, cool water, even in the hottest weather; but owing to neglect is defiled every day. The yard in which is the well, is paved with large flag-stones, but these in course of time, have, in many places become displaced, and the consequence is that the water in which the

people around, after the custom in India, and a very bad custom it is, have washed their bodies and clothes, trickles back into the well through the sodden earth, instead of running clear away as was intended when the well was originally constructed. Looking at the well whilst the process of washing, &c., was going on all around, we could see the water streaming back down the side of the well, the wall of which was discovered from the percolation.

When the cholera was making its way down from the north-west to our Presidency at the end of the last and commencement of this year, I was asked by Mr. Price, Collector of Chingleput, to send him a few simple rules on sanitation of villages, that he might publish them in his District Gazette. Subsequently hearing from him that the rules I had sent answered the purpose and were sufficiently simple and intelligible to the people, I took it upon myself to send a copy of them to all Presidents of Municipalities and Local Fund Boards. Lately I found myself inspecting a municipality in the North (Berhampore) a long way from Madras, and the manager showed me amongst the proceedings of the Commissioners of that municipality, a resolution calling attention to my circular, and resolving that two important tanks which I will call A and B, should be strictly set aside for drinking purposes, and a policeman set over each to prevent people washing their bodies and clothes therein. Next morning we were going round the town, when the manager pointed out in the distance a bank which he said was the bund of tank A, one of the tanks in which washing of clothes and bodies were strictly prohibited. We went, the doctor of the station as well as the manager of the municipality were with me. We were soon there, and certainly it was a magnificent tank. There were crowds of people at all four sides and all, or nearly all busily engaged in washing their clothes, and those that were not doing that were bathing their bodies. Just where we had reached the tank was an old man washing a not very clean cloth, and when he had done he washed himself, and spat repeatedly in the water. He then went away, and within a minute a woman came there, stood almost in the identical spot the old man stood a minute before, and filled two bright brass chatties with the water, and took them home for drinking and cooking. She must of necessity have taken home some of the filth from the old man's clothes and a portion of his spittle to drink and cook with. Now what we have just seen under our eyes was taking place at various times of the day all round this tank, and not only all round this tank, but around the hundreds and thousands of tanks which lie scattered over this fair continent of India.

In Vizianagram I saw a tank, much frequented by the women, who in hundreds might be seen taking home chatties upon chatties of water for domestic purposes, into which no less than eight large drains emptied themselves, and the cattle in numbers were daily washed.

It is needless to go on repeating these examples, they are universal, and I may, perhaps, not be deemed quixotic when I say that with the example of Guntúr before us, and the happy effects of careful water conservancy of late years at all the great fairs and festivals, I see no reason or difficulty why in every municipality and town, and presently in every village, the water for drinking purposes should not be carefully preserved from the frightful contamination which obtains at present.

I believe it would serve a useful purpose and induce the people themselves to assist in keeping their drinking water uncontaminated if at every tank thus set apart an extract from their own Vedas, such as I have quoted above, were legibly printed in the vernacular on a board and exposed in a conspicuous place.

Until this is effected, and as I have pointed out in a recent letter to Government it seems practicable at a comparatively small cost to municipalities and communities, all other sanitary improvements must be carried on in vain. Fairly clean, wholesome, drinking water is a primary necessity for the sanitary welfare of a community.

The Government in reviewing last year's report (1880) observed they were "satisfied "with the sanitary progress of the year; but they trust that it may prove to be practicable "to secure close sanitary inspection, &c." The remarks of the Army Sanitary Commission have frequently pointed in the same direction; thus in their remarks on the report for 1876 they write: "The facts as a whole lead to the same result as those "derived from the villages that the Sanitary Commissioner should have the means "placed at his disposal for fulfilling the practical duties of his office. No man, be he "ever so zealous, could do much real sanitary work for 29 millions of people. It is "quite enough for him to superintend and advise, and he should have the means of doing "so placed at his disposal." My predecessor drew attention in 1878 to the fact that whilst in Bombay, a smaller presidency, the Sanitary Commissioner was aided by five

Commissioned Medical Officers employed as Deputy Sanitary Commissioners and Inspector of Vaccination; in Madras there was only one officer at the disposal of the Sanitary Commissioner.

The Sanitary Commissioner with the Government of India draws an unfavourable comparison of the results of vaccination between Madras and Bombay: "The results "recorded in last year's annual report showed that in the Madras Presidency only 3·9 "per cent. of the estimated births were protected during 1879. During 1880, however, this "proportion was nearly doubled, as it is estimated that 6·9 per cent. of the children born "during the year were successfully vaccinated." In Bombay he writes: "The work of "the special department is supervised by five Deputy Sanitary Commissioners. It is "estimated that 37·9 per cent. of the children born during the year were successfully "operated upon, and that the ratio of successful vaccination per 1,000 of the population "was 25·2." The present Acting Deputy Sanitary Commissioner and Inspector of Vaccination, Dr. Price, writes in a late report after inspecting the north: "With the "exception of the Cuddapah District vaccination seems to me to be in a more backward "and worse state in the Godávari, Kistna, and Nellore Districts than in any others I "have yet visited. More personal European supervision is evidently required to put it "upon anything like a proper footing. According to the present rules the Inspector of "Vaccination is expected to visit each district once in two years; long before that time "any little good my personal inspection may have done is sure to have evaporated. My "opinion is that to be of any real use every Deputy Inspector ought to be able to see "each vaccinator under him at least once in three months, and ought to be inspected "himself by a European officer at least once in six months."

If closer sanitary inspection is desired, and I am perfectly convinced of its necessity not only as regards purely sanitary matters, but also in regard to vaccination, I would venture to suggest Government be good enough to strengthen my hands by appointing a second Deputy Sanitary Commissioner.

ABSTRACT OF REPORT OF THE SANITARY COMMISSIONER FOR BOMBAY FOR 1881.

(Mr. John Lumsdaine.)

General Population.

Census of 1881.

It is thought that the report will be more complete if prefaced by a table showing the area of the several registration divisions, and districts, together with the enumerated population for each and its density. Such a table is here appended, and it is proposed to repeat it every year for general reference. It will be seen that by the census taken on the night of the 17th February 1881, the total population of the districts named was 16,454,414, thus made up:—

8,497,718 Males.
7,956,696 Females.

16,454,414

The total area is 123,860 square miles, and the average numbers per square mile are 132·85. The densities range from 15·98 in Thar and Párkar to 35,145·27 in the city of Bombay; but excluding this terribly overcrowded city, and the sparsely peopled Province of Sind, the general average for the other districts is 174·37 persons per square mile.

Table showing for the Districts named, the area, the enumerated population by the Census of 17th February 1881, and the number of persons per square mile.

Divisions.	No.	Registration District.	Area in square miles.	Enumerated Population. Males.	Females.	Persons.	Persons per square mile.
Northern Deccan.	1	Khándesh	9,944	632,468	604,763	1,237,231	124·42
	2	Násik	5,940	397,404	383,802	781,206	131·51
	3	Ahmednagar	6,666	381,602	369,626	751,228	112·69
	4	Poona	5,348	455,101	445,520	900,621	168·40
	5	Sholápur	4,621	294,814	287,873	582,487	126·04
Southern Deccan.	6	Sátára	4,988	532,525	529,825	1,062,350	212·98
	7	Belgaum	4,657	434,485	429,529	864,014	185·53
	8	Dhárwár	4,535	442,035	440,872	882,907	194·68
	9	Kaládgi	5,757	317,611	320,882	638,493	110·90
Konkan.	10	Kánara	3,911	223,005	198,835	421,840	107·85
	11	Ratnágirí	3,922	473,053	524,017	997,070	254·22
	12	Kolába	1,496	191,952	189,697	381,649	255·11
	13	Bombay City	22	464,763	308,433	773,196	35,145·27
	14	Thána	4,243	468,236	440,312	908,548	214·12
Gujarat.	15	Surat	1,662	306,015	308,183	614,198	369·55
	16	Broach	1,453	168,482	158,448	326,930	225·00
	17	Kaira	1,609	426,721	378,019	804,800	500·18
	18	Panch Mahális	1,613	131,162	124,317	255,479	158·38
	19	Ahmedabad	3,821	439,394	416,930	856,324	224·10
Sind.	20	Karáchi	14,115	265,988	212,700	478,688	33·91
	21	Hyderábad	9,030	407,243	347,381	754,624	83·57
	22	Thar and Párkar	12,729	112,400	90,944	203,344	15·98
	23	Shikárpur	10,004	461,035	391,953	852,986	85·29
	24	Upper Sind Frontier	1,877	70,166	54,015	124,181	66·16
Abstract.							
Northern Deccan			32,419	2,161,389	2,091,384	4,252,773	131·18
Southern Deccan			19,937	1,726,656	1,721,108	3,447,764	172·93
Konkan			13,594	1,821,009	1,661,314	3,482,323	256·17
Gujarát			10,158	1,471,834	1,385,897	2,857,731	281·33
Sind			47,752	1,316,830	1,096,993	2,413,823	50·55
The Presidency			123,860	8,497,718	7,956,696	16,454,414	132·85

Note.—This table includes the military population, which is 35,660.

Comparing the numbers of the former census, February 22nd, 1872, with those of the last, February 17th, 1881, it is found that the net increase is neither general nor so large as might have been expected; and the figures alone show, that, during the nine years, there must have been disturbing factors. For the Northern Deccan the increase is 65,917, for the Konkan it is 222,547, for Eastern Gujarát 43,704, for Sind 210,646, and for the Presidency 177,528. For the Southern Deccan there is a net decrease of 365,286.

Vital statistics.

The number of births registered in 1881 was 459,657, and of these births 239,912 were male and 219,745 were female. In 1880 the registered total was 370,873, and by sexes the numbers were respectively 195,285 and 175,588. For the nine years, from 1872 to 1880 inclusive, the mean annual registered total is 310,004; thus made up of 163,194 males and 146,810 females. The total for 1881 is higher by 88,784 than that for 1880, and it exceeds by 149,653 the mean annual total for the last nine years; it is presumptive proof of improved registration. The general birth-rate for the year was 27·93 per 1,000 of population. For male births it was 28·23, and for female 27·62. In 1880 the general birth-rate was 22·85. For males it was 23·02 and for females 22·67; the general annual mean for the last nine years is 19·10 per 1,000 of population. It will be seen that the general birth-rate for 1881 is higher by 5·08 than that for 1880, and it exceeds by 8·83 the mean rate for the past nine years. The proportion of male to female children born was 109·18 to 100; last year it was 111·22, and the mean annual total for the last nine years was 111·16. In every 100 births there were 52·19 males and 47·81 females, and for every 100 males there were 91·59 females. In 1880 there were 89·91 females for every 100 males and the annual mean for the last nine years was 89·96. The ratio of boys born alive has again exceeded that of girls.

In each division and district the number of births recorded was in excess of the annual mean for the preceding 9 years. But taking the number registered for each district in each year from 1872 to 1880, and comparing it with that for 1881, it will be seen, that in 3 out of 24 districts, the number for 1881 was lower. In Ahmednagar the number registered in 1876 was 24,427 against 24,313 in 1881. In Ratnágiri, in 1875 and 1876, it was 16,473 and 16,451 respectively against 16,200. In Bombay City in 1880 it was 16,997 against 16,381.

In 22 out of the 24 districts the mean annual birth-rate for the 9 years ending with 1880 was below the mean annual death-rate for the same period. In 1881 the birth-rates were lower than the death-rates in Bombay City, Broach, Ahmedabad, Karáchi, and Hyderabad, in all other districts they are higher. At Sátára they were respectively 35·14 and 21·35, at Belgaum 35·90 and 23·30, at Dhárwár 37·73 and 23·20, in the Panch Mahals 40·03 and 17·43, and at Thar and Párkar 27·01 and 16·98. For the Presidency the birth and the death-rates were respectively 27·93 and 23·18: only twice—in 1874 and 1880—has the birth-rate exceeded the death-rate.

Amongst the civil population, the total of deaths recorded in 1881 was 381,450. By sexes there were 202,166 of males and 179,284 of females. In 1880 the registered number was 328,673, and the mean annual number for 9 years ending with 1880 was 395,281. The computed death-rate per 1,000 of population was 23·18, and for 1880 it was 20·25. For the 9 years ending with 1880 the average was 24·35, so for 1881 it was higher by 2·93 than for 1880, but less by 1·17 than the mean for the preceding 9 years.

The death-rates by districts per 1,000 of population ranged from 37·91 in Broach to 6·56 in the Upper Sind Frontier. In 1880 the maximum ratio (32·39) was in Bombay City, and the minimum (6·95) in the Upper Sind Frontier. In 1881 the greatest number of deaths (30,661) occurred in the Khándesh district, and the least number (815) in the Upper Sind Frontier. In 1880 the extremes were at Ahmedabad and the Upper Sind Frontier—24,539 and 625.

The results of deaths at different stages of life, for 1881, as compared with 1880, show a marked increase in the number recorded under each. Taking the mean mortality for the past 7 years, there was a remarkable decline in the number this year in each stage of life, except for infants unable to walk. For these in 1881 the ratio is 164·69 against 94·55 in 1880. For old people over 50 it is 45·25 against 60·80. Taking the percentage on total deaths, the highest (36·30) is amongst adults, and the lowest (19·76) amongst infants.

The following table shows deaths from specified causes for each year from 1872 to 1880, and the annual mean for this period is contrasted with the total for 1881:—

Years.	Deaths by Causes.						
	Cholera.	Small-pox.	Fevers.	Bowel Complaints.	Injuries.	All other causes.	All causes.
1872	15,642	26,699	206,747	33,664	5,804	67,404	355,960
1873	283	9,935	188,201	26,259	5,951	60,343	290,972
1874	37	3,903	183,717	26,990	6,165	57,840	278,652
1875	47,555	3,461	219,156	33,650	6,217	65,679	375,718
1876	32,117	14,817	220,833	33,683	5,923	63,882	358,266
1877	97,252	27,369	336,865	60,257	7,539	138,426	627,708
1878	46,743	4,475	357,376	41,165	7,556	75,642	532,951
1879	6,937	1,156	286,526	26,349	7,107	59,467	387,542
1880	684	940	246,779	24,452	6,082	49,736	328,673
Total	207,250	89,755	2,246,200	306,469	58,343	638,419	3,546,436
Mean for nine years	23,028	9,973	249,578	34,052	6,482	70,935	394,048
Ratio per 1,000 of population enumerated at the Census of 1872	1·42	0·61	15·38	2·10	0·40	4·37	24·28
1881	16,694	539	272,403	30,342	5,950	55,522	381,450
Ratio per 1,000 of population enumerated at the Census of 1881	1·01	0·03	16·56	1·84	0·36	3·38	23·18

N.B.—In the Shikárpur District the total of deaths in 1872 was 14,097; the cause details were so imperfect that they are not included in the total for that year.

Before speaking of the cholera mortality of 1881, it may be noted that the results tend to bear out the triennial wave theory hinted at in former reports. The subjoined table shows year by year for the period indicated, and for each division, the registered deaths from cholera, and the totals for the 16th year are so placed, as to contrast with the means of the previous 15 years.

Cholera.

Divisions.	Population by Census of 1881.	1866.	1867.	1868.	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	1880.	Total for 15 years.	Means for 15 years.	1881.
Northern Deccan	4,282,773	2,872	180	3,820	8,178	710	3,071	10,333	—	7	22,151	4,451	11,444	15,290	578	630	83,150	5,677	10,001
Southern Deccan	3,447,704	16,394	90	1,342	23,232	894	236	4,081	127	1	19,055	19,802	36,263	15,163	9	18	124,075	8,472	1,256
Konkan	3,455,323	1,474	327	991	3,630	856	1,457	741	197	19	3,293	2,273	12,209	4,294	1,220	127	30,439	2,223	2,233
Gujarát	2,852,731	488	196	241	2,469	145	55	212	53	25	6,089	6,974	4,896	11,670	280	9	32,063	2,524	3,102
Sind	2,443,630	9	4,356	27	2,513	—	—	—	—	—	26	88	—	25	3,440	—	10,107	1,009	—
Total	16,484,161	21,237	5,143	6,342	39,932	2,605	5,819	15,612	377	52	50,655	33,117	67,282	46,442	5,527	784	302,834	20,172	16,694

It will be seen that for the 15 years period, from 1866 to 1880 inclusive, 302,584 deaths were registered from cholera, and this would give an annual rate of 20,172. With an equable rate, and with the grand total of the last census, out of every 816 persons living *one* died of cholera. Looking at the last line of the table it will be seen, that for 16 years the triennial recurrence is unbroken: in the 11th and 12th years the famine was a disturbing factor, and the high number for the 13th year marks it as a recurrent year. The total then falls from 46,743 to 6,937, and in the next year to 684: in the next, however—the 16th—the wave returns, and the deaths are 16,694.

Of our 285 registration circles, 144 were affected, and the total mortality was 16,694. These deaths were distributed over 18 districts or collectorates, and 1,563 units of registration. The ratio per 1,000 of cholera deaths to the population of the Presidency was 1·01. Out of the 223 rural circles, 55 town circles and 7 civil cantonment circles, 115, 25 and 4 were respectively affected. Out of 24,535 inhabited villages, 1,534 were affected.

All the five districts in the Northern Deccan Division were affected, and the attacks and deaths were 22,056 and 10,001, against 705 and 530, in the preceding year. In the Southern Deccan, it prevailed more or less in all four districts and in this division, the attacks and deaths were 3,239 and 1,358 respectively, against 42 and 18. In the Konkan Division, it also appeared in all the five districts, and the attacks and deaths were 3,576 and 2,233, against 199 and 127 in 1880. In Gujarát, 4, out of the 5 districts, were affected, and the attacks and deaths were 6,011 and 3,102 respectively, the figures for the preceding year being only 25 and 9, but had it not been for the Surat District, which alone contributed 5,388 attacks and 2,751 deaths, the cases for the division would have been very few. The Panch Mahals District of this division was exempt during the year. There was only one case reported from the Shikárpur District of the Sind Division, and it recovered. The rest of the Sind districts were exempt during the year as well as in the previous year.

Small-pox.

In 1881 the registered deaths from small-pox were 539, and shown by sexes there were 301 of males and 238 of females; the mean annual number for the last nine years is 9,973. Out of the 24 districts seven were exempt, in nine the deaths were below 10, and in the remaining eight Shikárpur stands first with a maximum of 202. Next was Karáchi with 102 deaths, Hyderabad with 55, Kolába with 49, Bombay City with 37, Upper Sind Frontier with 28, Ratnágiri with 19 and Thána with 16. By divisions Sind headed the list with 391 deaths, the Konkan following with 122, and Gujarát, and the Northern and Southern Deccan with 12, 10 and 4 respectively.

The following table shows the deaths for each month, those under one year, under 12, and above 12, and it will be seen from it that the minimum mortality was amongst infants under one year and the maximum amongst those above 12 years:—

—	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	[illegible]	[illegible]	Oct.	Nov.	Dec.	Total.
Total deaths from small-pox in each month	26	65	79	89	81	86	37	[illegible]	13	12	5	18	539
Deaths under 1 year - - -	4	12	16	22	20	26	7	9	5	4	1	6	132
Do. do. 12 years - - -	2	21	26	33	34	31	12	15	5	3	3	9	194
Do. above 12 years - - -	20	32	37	34	27	29	18	4	3	5	1	3	213

Fever.

The deaths from fever in 1881 were 272,403 against 246,779 last year, and by sexes there were 143,929 of males, and 128,474 of females; this shows an increase of 25,624 deaths during the year.

In the Northern Deccan, Gujarát and Sind Divisions there was an increase of 32,257 deaths over those of last year, whilst there was a decrease of 6,633 in the Konkan and the Southern Deccan Divisions. For the Presidency the total increase for the year was 25,624. With the exception of the Belgaum, Dhárwár, Kaládgi and Ratnágiri Districts, and Bombay City, there was an increase, more or less, in each district over that of last year. The highest ratio of mortality during the year was 33·14 in Broach, and the lowest was 5·37 in the Upper Sind Frontier. By divisions the maximum mortality (25·62) was in Gujarát and the minimum (11·42) in Sind.

Bowel complaints.

The deaths from bowel-complaints during the year under report were 30,342 against 24,452 last year, showing therefore an increase of 5,890. By sexes, there were 16,842 of males, and 13,500 of females.

Except in the Sind Division there was an increase in the number of deaths from bowel-complaints during the year under report, but compared with the mean of the nine previous years there was a decrease for the Presidency of 3,710, and when compared with the number of 1880 there was an increase in each district except in Kánara, Kolába, Panch Máháls, Hyderabad and Thar and Párkar. The highest ratio 3·68 per 1,000 during the year was in Khándesh, and the lowest 0·03 was in Thar and Párkar.

Vaccination.

The following table contrasts the work amongst the civil and military population during the year under report with that for 1880–81:—

Establishment.	Persons primarily vaccinated.				Persons re-vaccinated.				Total number of Persons operated on.			
	1880-81.	1881-82.	Increase.	Decrease.	1880-81.	1881-82.	Increase.	Decrease.	1880-81.	1881-82.	Increase.	Decrease.
IN CIVIL LIFE.												
Itinerant - -	615,559	698,109	8,250 / 13·41	—	54,557	51,820	—	3,237 / 5·93	670,116	749,429	79,313 / 11·84	—
Dispensary - -	22,732	26,813	4,081 / 17·95	—	2,479	2,495	16 / 0·65	—	25,211	29,308	4,097 / 16·25	—
Total - -	638,291	724,922	86,631 / 13·57	—	57,036	53,815	16 / 0·03	3,237 / 5·68	695,327	778,737	83,410 / 12·00	—
IN ARMY LIFE.												
Native Army - -	3,555	3,830	275 / 7·74	—	2,837	1,917	—	920 / 32·43	6,392	5,747	—	645 / 10·09
British Army - -	659	571	—	88 / 13·35	2,606	1,037	—	1,569 / 60·21	3,265	1,608	—	1,657 / 50·75
Total - -	4,214	4,401	275 / 6·53	88 / 2·09	5,443	2,954	—	2,489 / 45·73	9,657	7,355	—	2,302 / 23·84
Total for the whole Presidency.	642,505	729,323	86,906 / 13·52	88 / 0·01	62,479	56,769	16 / 0·03	5,726 / 9·16	704,984	786,092	83,410 / 11·83	2,302 / 0·33

It will be observed that there were 729,323 persons primarily vaccinated, and 56,769 re-vaccinated, against 642,505 and 62,479 in 1880–81; showing a net increase of 86,818,

or 13·51 per cent., under primary vaccinations, and a net decrease of 5,710, or 9·14 per cent., under re-vaccinations. There was a considerable decrease (5,726 persons) under re-vaccinations amongst Native and European troops and the itinerant establishments, the figures being 54,274 against 60,000 in the preceding year. The rate of increase in re-vaccinations was only 0·65 per cent. in the work of dispensaries. On the whole, there has been an increase of 81,108, or, in other words, for every 100 persons operated on in 1880-81 the numbers for this year have been 111·50.

Out of 729,323 persons primarily vaccinated, 703,923 cases were successful, or 96·52, the highest percentage ever attained, against 95·95 in 1880-81, 95·11 in 1879-80, and 94·53 in 1878-79; thus showing that there was an improvement in the quality and the quantity of the work performed during the year. The number of unsuccessful cases also compares favourably with those of the previous years, being 14,061 against 14,721, 15,178, and 19,425. Secondary operations, after the failure of the first, were performed on 2,701 persons, and 14,040 persons escaped observation.

During the year 56,769 persons were re-vaccinated, against 62,479 for 1880-81. In 162 instances the re-vaccinations were repeated; in 6,091 instances the results could not be ascertained; and in 10,165 it failed. The number of successful cases was 40,675 or 71·65 per 100, against 72·79 in the preceding year.

The total number of persons operated on were 786,692 and of these 744,598, or 94·72 per cent., were successful. In 1880-81 the percentage was 93·90. There were 2,863 persons operated on more than once; the "unsuccessful" numbered 24,226, and the "unknown" cases were 20,131.

The age details are compiled for three stages, viz. those under one year, those between one and six years, and those above six years. The numbers under each stage primarily vaccinated were respectively 479,000, 231,352 and 18,971 against 396,618, 223,988 and 21,899 during the preceding year. The number of infants successfully vaccinated was 463,311, of children between one and six years 223,313, and of persons of other ages 17,299. Thus out of every 100 persons primarily vaccinated there were 65·68 infants, of whom 63·53 were successfully vaccinated against 59·58 in 1880-81, 52·71 in 1879-80, 52·11 in 1878-79, 47·55 in 1877-78, and 42·18 in 1876-77. Thus every year is characterised by a progress in the protection afforded to infants.

Animal vaccination was carried on in Bombay and Poona. In Karáchi it has been discontinued since last year.

In Poona 35 out of 39 heifers were successfully inoculated. Their cost was Rs. 133-3-6 against Rs. 184-10-3 last year. In Bombay 434 heifers were inoculated against 406 during the preceding year. On 34 heifers the operations proved unsuccessful. Three calves were inoculated successfully out of 13 with the Brussels cow-lymph received from Dr. Warlomont. The total cost was Rs. 3,146-5-10, whilst last year it was Rs. 2,505-4-3. As the lymph showed a great tendency to degenerate in the calves inoculated during the months of August, September, October, December, and January, animal lymph was also obtained from the animal vaccine establishment at Manningtree, England, at exorbitant rates, but all the supplies failed. However, the lymph from Brussels succeeded in three calves, and so it was re-established. Animal lymph was sent to Tasmania, New South Wales, China, and the Civil Surgeon at Surat.

Except in Bombay, where animal lymph only is kept up, and in Poona where both animal and human lymph were in use, vaccination in all other places was carried on from arm to arm and with human lymph. On the whole, the number of heifers inoculated was 473, and in 38 it failed; the total cost was Rs. 3,279-9-4.

The total cost for the whole Presidency, including all charges, was Rs. 2,60,355-14-2, and the successful cases, excluding dispensaries and the army, were 712,475. The average cost per each successful case was annas 5-10 or 2 pies less than last year.

Taking the work of all the Deputy Sanitary Commissioners, Superintendents, Assistant Superintendents, and Inspectors together, there were 5,289 encampments; 88,941½ miles travelled in 9,218 days; and 343,652 children inspected in 14,762 villages. Out of every 100 persons operated on, 43·72 were this year inspected against 46·27 in the preceding year, 43·10 in 1879-80, 45·58 in 1878-79, and 35·53 in 1877-78.

The Compulsory Vaccination Act (I. of 1877) has been in force for four years, and continues to work fairly well.

This is the second complete year in which the Karáchi Vaccination Act (No. IV. of 1879) has been worked in that city, and although there was a decrease in the quantity (the number of operations having fallen from 5,629 in 1880-81 to 4,655) owing to many unprotected children above one year of age having been operated on in 1880-81, great improvement has been effected in the quality of the work performed over that of the last year.

Sanitary Works.

Military works.

The actual outlay on sanitary works (military) during 1881, amounted to Rs. 4,22,109; of this sum, Rs. 2,43,103 were spent at Nasirabad, of which Rs. 2,43,061 were for supplying water from the Dauta reservoir. At Aden Rs. 39,952 were expended on the construction of lines for a company of sappers and miners, quarters for the engineer in charge, Leera condenser, and some minor works. At several other military cantonments smaller sums were spent on sanitary works.

Civil works.

The original reports received from municipalities are exceedingly valuable, but they are far too lengthy to be published *in extenso*. They have been abstracted and the results are given in the report.

The total annual income of the various municipalities was Rs. 25,69,791, and the sum expended on conservancy by them during the year 1880–81 was Rs. 6,33,713.

General Remarks.

The following are some of the points of special interest connected with the inspections made during the year.

Thána Water-supply.—In July 1880 a water-supply scheme for the town of Thána, planned by Mr. Maclaren, C.E., was sanctioned, and water was supplied in July 1881. The storage reservoir is N.W. of the town, distant about 2 miles. The water is impounded by an earthen dam 1,005 feet in length and 31½ feet maximum height, the level of the waste weir being 6½ feet, and of highest flood level 5 feet below the top of the dam. The surface area at level of waste weir sill is 489,400 square feet and the total cubic capacity at that level is 4,304,320 cubic feet, equal to 27 million gallons. The outlet is by means of a masonry tower provided with valves at every 5 feet in height, the pipe from which, 10 inches in diameter, passes below the dam in a trench cut into the solid rock, and filled in with concrete. The cast-iron main to the town is 7 inches in diameter and 10,365 feet in length, having a fall from the reservoir to the town of 108 feet. At the town end of the main is a valve, and meter-house where the quantity of water daily passing into the town is measured, registered and controlled. The distribution is by cast-iron pipes of suitable sizes to hydrants situated in different parts of the town. There are in all 16 hydrants with 67 taps, all of which are self-closing to prevent waste. The storage reservoir is calculated to hold sufficient water, after deducting loss by evaporation, &c., to give a supply of 5½ gallons per head of population, taken at 15,000, the numbers by the last census being 14,456. To this amount may be added the yield of a spring in the reservoir which has been gauged at 37,500 gallons in 24 hours, making the total available supply 8 gallons per head per diem. The total cost of the works has been Rs. 84,630, provided partly from municipal and partly from the Thána District local funds. The value of the supply will be appreciated when it is remembered that the majority of the tanks and wells were more than ordinarily impure, and were said to give rise to guinea-worm—in fact the well in the Collector's compound was about the only good one. In addition to the improved water-supply, improved markets are being constructed, and the municipality are now reclaiming with town sweepings a considerable area which was under tidal influence.

Pandharpur Water-supply.—This water-supply has caused much correspondence, and no little anxiety, by its quality having become somewhat suddenly impaired. This led to a thorough inspection of the entire system, the catchment area has received special attention, and not only has it been enlarged, but arrangements have been made for filtration. The original project was drawn up by Major Penny, R.E., in 1868, and he, together with Mr. Whiting and Mr. Burke were respectively employed in the construction of the works. By the last census the population of the town is 16,917 persons, but the temple of Vitoba is one of the great centres of pilgrimage, and the visitors or pilgrims often exceed 100,000. The average total rainfall is 26 inches, and the average monsoon fall is 24 inches. In preparing the scheme the minimum rainfall was assumed at 13 inches, and the record of 19 years shows that in two only, which were exceptional, it was less than 13; the range has been from 6·84 to 36·69. The quantity of rainfall flowing off the catchment area of 10 square miles was gauged from the 12th to the 15th September last, and, within those dates, the rainfall being 6·75 inches, the amount on the catchment area is 156,816,000 cubic feet; of this amount 46,742,542 cubic feet or 0·297 flowed into the tank.

In preparing the original scheme one-fourth of an exceptionally small rainfall of 13 inches was assumed as at least available, that is $\frac{13}{4} = 3\frac{1}{4}$ inches, which yields 43,037,280 cubic feet, and making all allowance for loss by evaporation and absorption, &c., would yield a quantity considerably in excess of the annual demand estimated at 10 gallons per head per diem for 25,000 persons. The catchment area of the tank was originally only 5·70 square miles, but this experience proved to be insufficient, as in years of small rainfall, when the falls occurred at long intervals, or falling in light showers rather than heavy falls, the tank did not fill. Works were therefore undertaken in 1877 by which the area was increased to 10 square miles, and this has proved to be sufficient. The area of the tank as now existing is at the level of the sill of the outlet sluice, or regulator, at reduced level 160 feet above datum, and 1,477·60 feet above "mean sea-level" = 2,032,795 square feet, or 46⅔ acres; and the area at the level of the "full supply" at reduced level 178·00 = 8,537,700 square feet, or about 196 acres.

The total capacity of the tank	= 89,330,058 cubic feet.
Deduct capacity of "bottom" or that below the level of the sill of the regulator -	10,163,975
Available capacity -	79,166,083

In preparing the scheme it was assumed that it would be necessary to provide for the daily supply of 25,000 people, allowing 10 gallons per head, that is, the total daily demand was estimated at 250,000 gallons, and the annual at 91,250,000 gallons. Regarding the actual quantity of water used, there is a difficulty in reducing this to a rate of expenditure per head, owing to the variable nature of the population. There is invariably a certain number of pilgrims at Pandharpur, sometimes only a few, and at others, during great fairs, a great many, and as it is impossible to obtain even an approximation to this variable number, it has been thought best to calculate the expenditure per head on the resident population or 16,917 inhabitants, according to the latest census. Adopting this the maximum and minimum rate of expenditure per head of fixed population were as follows:—

	Maximum per head.	Minimum per head.
1879 - - - -	9·28 gallons.	7·20 gallons.
1880 - - - -	9·37 „	6·48 „

In December and January last, when there were very few pilgrims at Pandharpur, experiments were made to determine the hourly rate of consumption. The results gave 115,000 gallons as the total for the day of 24 hours, and 6·79 gallons as the average quantity per head for 16,917 persons. The distribution in the town and environs is by means of 38 stand posts, some fitted with 4, some with 2, and others with 1 tap. There are also 3 iron cisterns fitted with 16 taps. These have been fixed where a larger demand prevails, but on the whole are inferior to the stand posts. Lambert's patent push-cocks have been found to be the most satisfactory in every way; they are simple in construction and action, admit of ready repairs, and allow practically no waste of water. The enlargement of the catchment area necessitated the construction of a weir across the Casegaon nála, a catch-water canal nearly 6 miles in length provided with suitable cross drainage works, and a silt trap at the tail: the results have been highly satisfactory. A system of filter beds has been arranged in the service reservoir which will satisfy immediate requirements, and can be used during the construction of larger and more permanent works should such be found necessary.

Before the supply was given there was hardly one single well in the town or suburbs of which the water could be said to be fit for drinking, and there was not one in which it could have been classed as good. The sacred character of the place necessarily fosters an intensity of prejudice, and at every pilgrim gathering numbers think it incumbent on them to take an unwholesome supply from the stream sacred, but polluted in every way it can be polluted. Notwithstanding this the supply is an immense boon, and it is very thoroughly appreciated.

In addition to water-supply there is a proposal for improving the drainage, and for erecting shelter sheds for 20,000 pilgrims. The general conservancy of the town is very fairly looked after.

Nasirabad.—In the memorandum by the Army Sanitary Commission on the health of British Troops during 1879, attention was called to the prevalence of enteric fever at

this station; and it was suggested that the question should be entrusted to me for inquiry and report. A special inspection of the cantonment was made in November last, and I may as well say at once, that there were absolutely no insanitary conditions, and no apparent causes to which the past sickness could be assigned. At the time of my visit the annual reliefs, and the expected arrival of the Viceroy at Ajmere had almost entirely denuded the place of its usual garrison. The barracks were barely occupied, and the lines were comparatively deserted.

The well water within the station is more or less brackish, but the drinking water for the troops is carted in from Dilwarra, a village some two miles distant. The well from which it is drawn is lined, and has a raised platform, the greater part of which is reserved for Government use. Seeing that this well always has been, and always will be a source of supply, it is strange that more care has not been taken of it. It borders a public road, and is uncovered. It is seemingly below the level of the village, and there is cultivation close up to it. For the troops it is drawn by mote, and an iron carrier pipe takes it to the road side at a sufficient height to let carts draw up under a filling hose. The villagers draw at will, and with their own ropes and vessels. Before my visit it had been cleaned out, and several cart-loads of black mud were removed. There was no available record of former cleaning.

A sample from the well itself was classed as bad; and the presence of such advanced organisms as rotifers, and the fact that there were 0·14 parts per million of albuminoid ammonia left no choice. The effect of thorough filtration in three samples from three hospital filters showed that the total solids were lowered from 28 to 25·9 and 25·6, the chlorine from 3·5 to 3·1 and 3, the free ammonia from ·02 to ·01 and ·005, the albuminoid ammonia from ·14 to ·06, ·04, and ·03, and the sediment, which contained *rotifers*, was all removed. The absence of organisms in the filtered sample may be taken as indicating that the conditions which produced them had disappeared; and similarly their presence in the well sample showed that, in the well, those conditions were still in force.

It is very evident, that, at the well, matters are not as they should be; and it is equally clear that something should be done to improve them. Covering it in will exclude once chance of accidental impurity, and another may be got rid of by preventing any cultivation on ground at a higher level within a certain radius, say 50 yards. The present mote should be dispensed with, and a lift and force pump substituted. This might be fitted alongside the well, and not over it so as to avoid any droppings of oil or grease. The water is only some 30 or 40 feet from the surface, and with a good lift the delivery might be at a point much near to camp, with a cistern sufficiently raised it might possibly be somewhere in camp. As each trip is one of four miles, the wear and tear of carriage, gear, and animals is worth consideration. One or more cisterns would have to be provided for the villagers to whom the well would then be closed, but as long as they get their supply without prejudice to caste scruples the mere deprivation of drawing it would be no hardship. I have suggested a lift and force pump, but of course if the fuel could be provided steam power would be preferable.

Another proposed source of supply is the Danta Lake, a newly constructed reservoir some 6 miles distant from which the water is brought by gravitation. It would be premature to express an opinion as to its future, but whether it be that the catchment area is insufficient, or whether the rainfall is too precarious, or the leakage too great, there is a floating suspicion that the supply is not all that was hoped for. The analysis was unfavourable, but the first examination of a new impounding reservoir is generally so. It showed total solids 15·4 grains per gallon; chlorine 4·2 grains per gallon; free ammonia 0·10 parts per million, and albuminoid ammonia 0·24. There are excellent filtering arrangements, but unfortunately they are at the wrong end of the main, and the consequent loss of head is seen at hydrants and taps. It is doubtful whether the supply can be extended to the bázár, and it will be a grievous disappointment if it cannot, but there is talk of forming another reservoir, and connecting it with that at Danta to supplement it

The Diggy Tank water is unmistakeably, and absolutely bad, but necessity compels its use in the bázár. The analysis of the wells shows what would be the condition were they chief sources of supply.

Sholápur Water-supply.—The town is now supplied by gravitation. The water is taken from the Ekrúk perennial canal at the 4th mile, and is first passed into a settling tank. It is then led to a well in the engine-house from which it is pumped into two reservoirs, at different levels. The supply is 5 gallons per head per diem for 50,666 persons. The distribution is by pipes, and hydrants, the quality is good, and all the arrangements are everywhere excellent.

Karáchi Water-supply.—Upwards of 20 years have passed since the feasibility of obtaining a water-supply from the Mulir river was first put forward; and at last, after interminable delays, the scheme has assumed a definite shape, and the works are approaching completion. In a bee line the head-works are 15½ miles east of the Somerset Barracks, but the length of the conduit is about 18 miles. There are two wells each 40 feet in diameter, within each of which is a cast-iron valve shaft with three 24 inch slide, or regulating valves placed at different heights working on it. The main delivery valve is also connected with the bottom of the shaft. All these valves are worked from a platform at the top of the well above ground level. From the main delivery valve for a distance of over a mile and a quarter a 24″ cast-iron pipe is to be laid. At the end of the pipe the masonry conduit commences. This is built of rubble masonry, and has a sectional area of 5 feet 6 inches, with a minimum fall of 3′ 9″ to the mile.

The capacity of discharge of the conduit is thus over 6 million gallons per diem. Flat cover stones with concrete on the top close in the conduit which is lined with Portland cement ½ inch thick. This conduit extends for the whole distance (16 miles) between the end of the 24-inch pipe before mentioned, and the distributing reservoir at Karáchi, except where it has to dip under the Thudda river and smaller nálas, and at these points syphons either of masonry, or of cast iron, are erected. The conduit discharges into an inlet well alongside the distribution reservoir: this well is 20 feet in diameter, and is built of ashlar set in concrete.

The distributing reservoir is 200′ × 150′, and will contain a depth of water of 11 feet, the total capacity being equal to 2,000,000 gallons. The reservoir and inlet well are connected by a 24-inch pipe, but communication between them can be cut off, when it is considered desirable to do so, by means of a sluice valve in the well. Both the reservoir, and the inlet well are provided with cleansing pipes taken off at 2 feet below the level of the main delivery pipe. The main delivery pipe has a branch into both the reservoir and the inlet well each branch, finishing with a 24-inch sluice valve. By this means the supply to the town can be taken direct from the inlet well without reference to the water in the reservoir. The main delivery pipe diminishes a little way from the reservoir to a 12-inch pipe, but it is hoped that this will be but a temporary measure, and that soon the 24-inch main will be laid into camp as originally proposed. The mains and sub-mains, and distributing pipes in the camp and city are of the ordinary description. At intervals where convenient at all the streets where the mains are laid, stand pipes, bullock and street services are to be erected.

The quantity of water provided for in the full scheme is 25 gallons per head per diem for 80,000 persons; but the present main can supply, for the same number, only 8 gallons. The quantity of water at present being discharged to waste from the pipe trench amounts to 1,800,000 gallons per day. As the excavation is still 1,000 feet from the site of the wells, and the wells themselves only excavated to water level, a very great increase on this quantity will yet be obtained. The discharge of water from the pipe trench has been steadily increasing since April 1881 when water was first tapped.

From this description it will be seen that the amount run to waste exceeds the estimated amount required, so the supply has been subjected to a most crucial test, and has not been affected by it. The quality seems to be all that can be desired, and after the brackish water now supplied, it will be most welcome. I had hoped to have obtained analyses of it, and of all the Sind waters, but the arrangements fell through; and they cannot be resumed until the cold season.

Sanitary condition of the town of Násik.—Násik, the chief town in the collectorate of the same name and the head-quarter station of the Collector, is situated in latitude 20° N. and longitude 73° 51′ E. on the table-land of the Deccan at an elevation in the higher parts of the town of 1,943 feet above the level of the sea from which it is distant as the crow flies 64 miles. The town has been built on the elevated ground sloping down to the river Godávari which a few miles above it splits up into several streams, which receive the drainage of the eastern spurs of a portion of the Sahyádri range and thus form the head waters of the river, but the best known and the most highly venerated source from which the sacred river springs is at Trimbak, about 19 miles to the south-west of Násik.

The country round Násik is somewhat bare and destitute of vegetation, though the situation of distant villages is marked by clumps of trees, but the immediate neighbourhood of the town is well-wooded and highly cultivated ground is found after crossing the river Nasardi, an affluent on the right bank of the Godávari and fine mango topes, with

burr, pipal, tamarind, and other trees afford a grateful shade to wayfarers and cattle, whilst the more distant landscape is on the south extending round to the west, rendered extremely picturesque by the ranges of hills which approach Násik within 4½ or 5 miles among which the cone-shaped hill of the sacred Pandav Lena with its far famed chaitrya caves, commenced according to Fergusson in 129 B.C., and the Chincola hills stand out prominently in the foreground, whilst at a distance of about 16 miles the flat-topped mountain of Unjnira rises to a height of about 4,300 feet above the level of the sea, near the summit of which there are bungalows which form a valuable health resort for residents in Khándesh and Nasik during the hot season. The Thul Ghát, down which the road to Bombay descends, is 28 miles distant in a straight line on the south-west, but the nearest point of the Sahyádri range is at Oonbar Ghát, only 15 miles away on the west. On the north extending round to the west are seen the funnel-shaped hill of Chambar Lena, the sacred hill and fort of Rámsej, the rugged outline of Bawaghur and the peak of Girnara.

The rock round Násik consists for the most part of black cotton soil or the disintegrated covering of the subjacent trap. This retains moisture to a large extent and is the source of much of the water which is carried off by the Nasardi river; which, rising among the hills to the south-west receives the drainage of the plain through which it flows. Its bed, in which water even during the hottest months of the year is always found, is at a considerably higher level than the town above which it passes until it joins the Godávari about 1½ miles below Násik.

The prevailing wind is westerly, and observations taken during the last seven years at the Civil Hospital, show that on the average it blew for upwards of 10 months in the year from the westward of north and south, and that for only one month in the year it blew from north-east-east or south-east.

The climate of Násik is very healthy and pleasant, and even in the hot season during the month of May the nights are cool and refreshing, although the wind during the day absorbs heat in passing across the plain.

Násik has been inhabited by man from the earliest ages. In fact its history is lost in fabulous antiquity. According to the Shastras the town was originally called Pudina Nagar, the Lotus city, but in course of ages this name was changed to Tritruntak, the city of the three giants who, in the old legends, are said to have ravaged the country until they were at last providentially killed. Again, the name of the city was changed to Janasthan the place of many people, but in historical times it has been called by its present name (Násik) the nose, the derivation of which is very uncertain, for whilst some attribute it to the sacredness of the town being worthy as it were to form the nose of the head of India, others have connected it with the exploits of Laxuman, the favourite brother of Rama, who is said to have cut off the nose of Soorp Nakha, the sister of Ravan, at Bhrama Yeni, (2) circular holes in the river bed near Tapovan, a short distance below the town. Others consider that the town obtained its name from the configuration of the hill on the south-east now known as Juna Guree.

The present town appears to have grown piecemeal and must present a very different aspect to what it formerly did. The part that has probably least altered is Punchvati, so-called from the five-burr (vad) trees overshadowing Sita Gumfa or cave from which it is believed by the faithful a subterranean passage leads to the hill of Rámsej (Rama's couch), eight miles away. It is situated on the rising ground on the north or left bank of the river, and extends along it between the Aruna nála on the west and the Vuruna or Wagadi nála on the east, and has probably from the many sacred associations connected with it been always considered the centre of religious attraction by devotees from all parts of India. The old city of Násik was situated further down on the opposite or south bank of the river and was said to stand on ten teks or hills. On the east it was bounded by the Nagjeri nála which discharges itself into the river below the causeway near the present Talkote's temple, and it probably extended on the west as far as the Sarasvati nála which is the principal watercourse of Násik and which discharges itself into the river at Ballaji's temple opposite Punchvati. Some of the Hindu names of these teks have been lost, and these are now known by the designations given them under Mahomedan rule.

The municipality of Násik was constituted a town municipality in 1874. The inhabitated area is estimated to cover about 462 acres, but this estimate appears to me to be rather a low one. For municipal purposes the town is divided into three sections, Kusba, Pura and Panchvati, but the Public Health Department has added a fourth by subdividing the kusba into Kusba and Kazipura. There are estimated to be 27 miles of thoroughfare, but there are only nine miles of metalled roads. The streets in the hilly parts of the town are in places too steep for wheeled vehicles, they are extremely narrow

and are for the most part paved with roughly hewn stones, an arrangement which is evidently necessary to prevent the surface being washed away during heavy rain.

The European quarter of the town is situated on the west of Návapura and is well exposed to the westerly breeze. There are, however, some old quarries near the bungalows which are filled with water during the rains and during the process of drying up must be the cause of malaria, especially as they are the resort of the dhobies during the monsoon.

Násik is a Bráhminical town, and I learn that there are 1,300 houses occupied by priests. There is a pilgrimage held here every year called the Rámnavmi, which lasts for four or five days in the month of April, when upwards of 10,000 pilgrims visit the town. Every 12th year is still more sacred, and then about 15,000 pilgrims collect. The dharmsháláis in the town are not sufficiently large to accommodate such vast numbers, and every year the river bank and Panchvati are crowded with pilgrims who in great numbers live in the open air, in the court-yards of the temples, &c.

The population of the town at the census of 1872 was 22,436, of whom 11,771 or 52·46 per cent. of the total were males and 10,665 or 47·54 per cent. females. The tables of the census of 1881 are not available as they have been sent to Poona for compilation, but at it 23,536 persons were enumerated, showing an increase in the last nine years of 1,100 persons or rather more than five per cent.

The chief source of drinking water-supply of Násik is the river Godávari, and the analysis made by Assistant Surgeon De Souza, the travelling water analyst attached to the Sanitary Department, proves how impure the water of the Godávari is and how entirely unsuited it is for a drinking-water supply. Wanklyn, the great authority on water analysis, says:—"If a water yield ·00 parts of albuminoid ammonia per "million it may be passed as organically pure despite of much free ammonia and "chlorides; and if indeed the albuminoid ammonia amounts to ·02 or less than ·05 parts "per million the water belongs to the class of very pure water. When the albuminoid "ammonia amounts to ·05, then the proportion of free ammonia becomes an element "in the calculation; and I should be inclined to regard with some suspicion a water "yielding a considerable quantity of free ammonia along with more than ·05 parts of "albuminoid ammonia per million. Free ammonia, however, being absent, or very small, "a water should not be condemned unless the albuminoid ammonia reaches something "like ·10 per million. Albuminoid ammonia above ·10 per million begins to be a very "suspicious sign; and over ·15 ought to condemn a water absolutely." According to the analysis of Mr. DeSouza the river above Naroo Shunker's Ghát, the highest point where it enters the town, contains ·14 parts of free ammonia and ·22 parts of albuminoid ammonia per million, so that even here according to Wanklyn's rules it is absolutely unfit for drinking, but it gets worse and worse as it flows past the town at Ram Khund. The quantity of both the free and the albuminoid ammonia is more than double, and at Dixit's Ghát it actually contains ·52 parts of free and ·74 parts of albuminoid ammonia per million. Comment is surely unnecessary to convince any one of the dangerous quality of such water.

Before the river reaches the town it is fouled by villages along its banks, and from the point it enters Násik above Naru Shankers Ghát it is fouled in almost every possible way. The refuse from the potters' kilns and from the place of deposit for town sweepings at Gharpurá's Ghát must find its way into the stream, whilst at the ford between Gharpurá and Dhángar Utara cattle are taken to water; and as they almost invariably micturate whilst drinking, it is not difficult to understand how the upper waters become fouled before they reach the Tas and the pool at Sunder Narayen whence great numbers draw their drinking water, especially when it is remembered that above these points the urine, ablution water and household sullage from a great portion of Aditwár are discharged into the river bed. The water in the Luximon and Ram Khund is simply diluted sewage, and lower down opposite Dixit's Ghat and between it and the Causeway is still more vilely polluted by percolation from the sewage delivered by the main drain.

Another source which is stated to be used by about 5,000 of the population is the water delivered at Dhondu Mahadeo Subedár's howd near Trimbak Gate. Unfortunately this water supply is private property, and much of it is used for irrigating a private field before it reaches the town; but even in its uncared-for and neglected state the water it delivers is of fair quality, though it contains ·12 parts per million of albuminoid ammonia, and would, if the tank and aqueduct become municipal property, no doubt after filtration be a very valuable source of water-supply. The municipality

in 1873 tried to purchase this property for a sum of Rs. 30,000, but unfortunately failed to come to terms with the owner and mortgagee of the property.

There are 825 wells in the town, generally of an impure character, 502 of which are in Kasba, 270 in Pura, and 53 in Panchvati. Only four of the wells are municipal property, three in Pura and one in Kasba.

The above description will portray the present sanitary state of Násik, and in the following section the vital statistics of the town, which have been doubtless to a very considerable extent influenced by the above conditions, are given. There has been a falling off in the number of births since 1874, when 636 births, equal to a ratio of 28·35 per 1,000 of population were registered. In India there are good grounds for believing that the annual birth-rate is about 40 per 1,000, so that instead of only 509 on the average, there ought to have been upwards of 940 births annually registered.

Since 1871 the death-rate has been abnormally high. It was lowest in that year, when it amounted to 32·98 per 1,000. During 1877 and 1878 it attained the very high rate of 64·09 and 78·40 per 1,000, respectively, but there were exceptional circumstances affecting the district in these years, but in 1872 it amounted to 57·94 and in 1875 to 51·30 per 1,000. During the last two years there has been a satisfactory decrease as the ratio in 1879 was 34·99 and in 1880 34·81 per 1,000. This rate, however, cannot be considered as anything but excessive in a town which enjoys such a salubrious climate and is so advantageously situated as Násik.

The following table shows the deaths arranged according to causes:—

Years.	Cholera.	Small-pox.	Fever.	Bowel Complaints.	Injuries.	All other causes.	All causes.	Ratio of Deaths per 1,000 of Population. Cholera.	Small-pox.	Fever.	Bowel Complaints.	Injuries.	All other Causes.	All Causes.
1871	61	16	270	58	10	325	740	2·72	0·71	12·03	2·58	0·45	14·49	32·98
1872	185	59	570	34	18	434	1,300	8·25	2·63	23·18	1·51	0·80	21·57	57·94
1873	—	1	458	15	17	548	1,039	—	0·04	20·42	0·69	0·75	24·42	46·31
1874	—	1	324	21	16	474	836	—	0·04	14·44	0·94	0·72	21·13	37·26
1875	168	1	357	46	11	568	1,151	7·49	0·04	15·91	2·05	0·49	25·32	51·30
1876	10	95	388	36	9	432	970	0·45	4·23	17·29	1·60	0·41	19·25	43·23
1877	158	128	597	94	11	450	1,438	7·04	5·71	26·61	4·19	0·49	20·05	64·09
1878	37	—	914	85	11	712	1,759	1·65	—	40·74	3·79	0·49	31·73	78·40
1879	—	—	432	56	9	288	785	—	—	19·25	2·49	0·41	12·84	34·99
1880	—	—	458	75	8	240	781	—	—	20·41	3·34	0·36	10·70	34·81
Mean for 10 years	62	30	472	52	12	452	1,080	2·76	1·34	21·04	2·31	0·53	20·15	48·14

Although in 1872–1875 and in 1877 there were a large number of deaths from cholera, during four of the 10 years under report, not a *single* death was registered from this cause, so that the general high death-rate is not due to the prevalence of cholera. Nor is it due to small-pox, which in only three years of the series was prevalent in the town. It will be at once seen that the chief cause of the mortality in Násik is fever, whilst deaths from bowel complaints bear a much higher ratio to the total mortality than they should do.

The sanitary condition of Násik must always be regarded by the Sanitary Commissioner with peculiar interest and anxiety, as the welfare of the entire Bombay Presidency may at any time be affected by it, for if cholera originates here during the Játtra it is likely to spread throughout the country, as occurred in 1875, when, though there were only 10 deaths from this disease in Násik, a cholera epidemic commenced which told terribly against the people of this Presidency for three successive years, during which time 183,667 persons fell victims to it. There is no doubt that much of the immunity which the town has enjoyed from cholera is due to the efficient manner in which the Public Health Department has performed its duty. I am sorry, therefore, to hear that it has been proposed, although I believe not seriously entertained, to increase the income of the municipality by reducing expenditure in the Public Health Department. There could be no more fatal step or one more likely to cause great injury to the public health throughout the Presidency. On the contrary, every support should be given to it, such as has been given to it in past years by Mr. Erskine and is now given to it by Mr. Ramsay, and I trust such will be always continued; for it would indeed be sad to see the sanitary condition of the town retrograde to what it was when Dr. Leith reported on it in 1865.

I am glad to learn that the question of imposing a tax upon pilgrims has been mooted, which I hope will be carried, as it seems a very legitimate and proper means of increasing

the income. The Pandharpur municipality raises not less than Rs. 25,000 per annum from a pilgrim tax, and I can see no reason why Násik should not augment its income by a similar tax; but I would suggest that pilgrims should be taxed according to a graded scale, for it seems inequitable that a rich Bania should pay exactly the same amount as a poor artizan.

The necessity for increasing the income is very evident, for the tables of mortality prove that a persistently high death-rate always obtains in Násik, and its cause is, in my opinion, chiefly due to impure water and to an atmosphere vitiated by the dangerous emanations from the drains. In my opinion the Godávari should be abandoned as a source of drinking water, as the analyses made by Mr. De Souza prove that the water of the river even as it enters the town is so impure as to be unfit for drinking, and that it becomes increasingly bad as it progresses through the town. It would be out of the question to try and prevent the people bathing or washing their clothes in it, or to stop them throwing in their offerings or the burnt bones of their dead. These customs are intimately connected with their religion, and I am quite confident Government would never sanction such an interference with their most cherished prejudices. It is necessary, however, to mention that it has been proposed that a dam should be built across the river higher up at Gangapur, and that the water should be brought in by conduit; but there are many objections to such a scheme, among which I would point out that the water would be rendered impure by the villagers in Gangapur and at Jelalpur which are situated on either bank a short distance above the place where the proposed dam would be, and another fatal objection is that the top of the rock at Gangapur is so low that the water could not mount up to the higher portions of the town.

The next point to which I wish to draw attention is the very dangerous condition of the existing drains. I am sorry to learn that the drain cleaning establishment which was formerly sanctioned was discontinued by order of the managing committee. This I think was a fatal mistake, as I am confident that there must be a large deposit in nearly every drain in the place. The quantity of sewage delivered at the outfall is much smaller than it ought to be, and there can be no doubt that the sewage stagnates hurtfully in the drains, which being square and roughly made, offer points for it to collect. The smell emanating from holes over the drains is absolutely sickening, and must injuriously affect the health of the people passing over the narrow streets in which they are situated. Drains ought to be built of brick evenly laid in Portland cement, and should be egg-shaped, but, as it is estimated that there are altogether in the town some 10 or 12 miles of drains, I do not suppose that the municipality would be in a position for many years to replace them by scientifically constructed drains. At present the covering slabs are cemented down so that it would be an ever-recurring item of expenditure to open them for the purpose of cleaning. They could, however, be periodically flushed even at present by temporarily ponding up the water by segments, but I would suggest that at frequent intervals in the course of each drain a manhole should be constructed, which could frequently be cleaned of any deposit brought down to it. Although it would be too expensive to have a thorough drainage system, I think no time should be lost in laying an intercepting sewer along the whole course of the margin of the river bank from Janappa's Ghát, so that the stream may not be fouled by the admission of sullage into it.

I am glad to see the municipality recognises the necessity for providing more accommodation for the people in the shape of public latrines. Much has been done in this respect already, but still more is needed, as the vacant places throughout the town are horribly defiled, and it is disgusting to see the cattle eating human ordure before the place can be cleaned by the bunghies, who are very diligent in performing this work. I think the Goodfellow's latrines lately introduced are a great improvement over the older pattern, but in all latrines I look upon a roof as a great mistake, as it confines the stench. I think all the roofs should be removed, and if these places must be sheltered during the monsoon, corrugated iron sheds might be reserved for covering them at that season.

From the foregoing observations it will not, I hope, be thought that I in any way underrate the great difficulties the municipality has to contend against, for I am certain that it utilises to the utmost advantage the means at its disposal; but I have endeavoured to point out the measures which appear to me the best calculated to improve the sanitary condition of this very interesting old town.

ABSTRACT OF REPORT OF THE CALCUTTA MUNICIPALITY FOR 1881.

(*Mr. H. L. Harrison.*)

A fresh census of Calcutta having taken place during the year 1881, it seems a proper occasion to preface the annual report with a summary of the latest statistical information which has been compiled, regarding that portion of the metropolis which is under the control of the Corporation.

The following table shows the area of the town proper of Calcutta, as also of the Esplanade including the Presidency Jail and Fort William, and the population ascertained in 1881 as compared with the previous census of 1876. For purposes of reference similar figures are given for the Suburbs and the Port, but it should be specially noted that in the case of the Suburbs the previous census was taken in 1872.

	Area in acres.	Population in 1876 (Suburbs 1872).	Population in 1881.
Town proper	3,754	4,09,036	4,01,671
Esplanade	1,283	2,803	3,348
Total	5,037	4,11,839	4,05,019
Add population afloat		17,696	28,200
Suburbs	14,413	2,57,149	2,51,439
Grand total	19,450	6,86,684	6,84,658

Taking the population of the town and Esplanade together it is thus divided into sexes—

	1876.	1881.
Males	2,64,863	2,60,780
Females	1,46,976	1,44,239
Total	4,11,839	4,05,019

The following figures showing the ratio of the sexes at different ages or stages of life are particularly instructive as setting forth in themselves the social condition of Calcutta almost without comment:—

	Percentage of Males.	Percentage of Females.	Percentage of Males and Females of the stated Ages to Total Population.	Similar Percentage in London.
From 0 to 4 inclusive	50·8	49·2	6·4	13·0
„ 5 to 9 „	52·7	47·3	6·3	11·1
„ 10 to 19 „	64·5	35·5	14·1	18·6
„ 20 to 39 „	70·1	29·9	48·3	33·4
„ 40 to 59 „	63·6	36·4	20·2	17·7
„ 60 and upwards	48·6	51·4	4·7	6·2
Total	64·4	35·6	100·0	100·0

To complete the evidence afforded by these figures, it is only necessary to give the statistics of unmarried, married, and widowed persons of the two sexes, which are as follows:—

Single.		Married.		Widowed.		Total.	
Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.
84,346	32,135	1,66,296	59,382	11,138	52,722	260,780	144,239

The life of Calcutta—not of the Europeans and Eurasians, who are too small a fraction materially to affect the result, but of the great bulk of the native population, can be easily read in these statistics. They show that far more than half the inhabitants of the town are dishomed, that they are temporary sojourners only, leaving their families, in some cases even in early boyhood, to earn a livelihood in the metropolis. The percentage of male to female children under 5 is as it should be, but before the age of 10 the preponderance of males begins to appear, and between the ages of 10 and 20 it becomes very manifest. Between 20 and 40 there are more than two men to every woman, and even between 40 and 60 the excess is very considerable. Only after the age of 60 do the migratory bread-winners disappear, and the equality of infancy is restored in old age.

Of married men only 36 per cent. can have their wives living with them in Calcutta or the Suburbs, so that at least 64 per cent. of the able-bodied males of Calcutta are living away from their families. This being the case, and remembering that the municipal area of Calcutta is strictly circumscribed and cannot expand, it is no matter for surprise that the population has rather decreased than increased. The resident population cannot reproduce itself at a rate sufficient to compensate for the mortality of the whole community: hence the population will decrease or increase according as the demand for labour decreases or increases, and as Mr. Beverley points out, it is by no means certain that the great development of machinery does not tend to diminish the demands of the labour market.

Town improvements.

The improvements that have been carried out in the town of Calcutta have been great, at the same time there still remains much that needs improving.

In 1860 the insanitary state of the town almost baffled description. A few years of vigorous administration, combined with the introduction of the drainage system into the southern portion of the town, so ameliorated its condition that the greater part of the European quarter underwent an entire transformation before 1870 or 1871. The northern portion of the town, however, embracing it must be remembered, by far the larger and more populous area, remained also almost untouched, except that one or two first class streets, especially Beadon Street and Grey Street, had been carried through it, and Beadon Square had been constructed. Since 1871 very little has been done for the southern portion of the town beyond the construction of the new market; except as regards bustees its sanitation has been regarded as nearly completed, but the work of improvement has been directed steadily northwards.

Under these circumstances, if special attention has not been paid to the condition of the southern portion of the town, it would be no matter for surprise. At first it was the show area of the town, the locality on which the main efforts of the conservancy officers were concentrated. Now the southern portion of the town has passed under routine management, the efforts of the superior officers of the municipality are rightly directed to improving the northern town, and levelling it up to the sanitary standard attained long ago in the south. Any one, therefore, who has only a practical knowledge of Calcutta south of Bow bazaar, is quite incapable of judging the work of the Corporation from his own personal observation, and any inference he might draw therefrom, as to the absence of sanitary progress, would be entirely misleading. On the other hand, weighed against an ideal standard of cleanliness, the condition of the northern portion of the town is still so glaringly defective that a person now visiting it for the first time, and not knowing what it was 20 or even 10 years ago, is equally disqualified from passing any judgment on the work done. Only those who have known this portion of the town well for many years past, and have observed its gradual but constant amelioration, especially in the wake of the drainage works, are fairly competent to criticise the work of the Commissioners in this respect.

The main agency at work, as above indicated, is the Drainage Department—the establishment which is engaged in the sewering of nearly all the streets, and of many of the ditches in the town. A separate portion of this report is devoted to this, which is one of the great engineering departments of the municipality, under the special charge of an Assistant Engineer: here it will suffice to say that, during the year 1881, it made very good progress and completed over 14 out of the 36 miles of sewers which yet remain to be constructed in accordance with the fixed programme. The sewering of each street enables the side-drains, formerly full of filthy sewage, to be filled in and obliterated, and the street to be thereby somewhat widened; it also enables all the premises on each side to be connected, and thereby provided with a channel for the escape of storm-water and sewage. On an average each mile of pipe sewering enables 200 premises to be connected, though all that have the facility afforded them do not readily avail themselves of it. In 1881 as a fact 1,592 premises were connected, but as

the bulk of the new piping was laid in the 4th quarter of the year, many of the connections resulting from the sewers were not made before 1882.

Next to the sewering and cleaning of existing streets, and the providing sewage connections for private premises, the great benefit conferred by the drainage operations is the construction of new roads over such sewers as have to be laid down through tracts where no road previously existed, and the substitution of metalled footpaths for such of the old filthy ditches as are no longer required. These ditches are now the greatest blots on the sanitation of the town; they contain the foulest matter in the most advanced stages of decomposition, and are practically mere stagnant cesspools between earthen banks, the soil of which is saturated with sewage. No greater improvement can be made than the substitution of a pipe sewer for a drain of this kind, and its conversion into a street or path, according to its width. In 1881 nine new roads were made in this manner by the Drainage Department.

The total length of public roads constructed or completed within the year comes to about 8,922 lineal feet, or about a mile and three quarters; nearly all of these roads will prove of great practical advantage. The first seven are north of Bow bazaar, and the last two south of it. Besides these roads about an equal length of public ditches has been converted into metalled paths or passages of an average width of six feet. Taken as a whole, very fair progress was made during the year in drainage and road-making.

Tank-filling proceeded as usual during the year, though the operation was somewhat impeded by—(1) the rains, which began early, and interrupted operations before the usual time; (2) the decision of a magistrate, which assumed that tank-filling on the system hitherto pursued was a public nuisance. On the other hand, the change in the law obliterating the distinction between the tanks within and not within private enclosures, enabled the Commissioners to recover a much larger portion of the expenditure than they had hitherto done. In all, 20 tanks were taken in hand in 1881. Of these 14 were entirely completed during the year, leaving six which have been completed in 1881.

In 1879 a survey was made of all the tanks in the town, which might be eventually filled up. It did not of course include the tanks on the maidan, or some other well-kept tanks in squares and private compounds. The survey showed that there remained 534 tanks to be filled up. Of these, 34 have been taken in hand in 1880 and 1881, leaving 500 untouched. It would, however, be a mistake to suppose that 500 tanks really require to be filled up. As remarked last year, the bustee register only shows 177 tanks, of which about one-tenth have been already filled up since the register was prepared. The great bulk of the remainder are in private compounds and are at present inaccessible to conservancy carts, while their condition is not nearly so bad as that of the tanks in bustees. Though the out-turn compared with the entire number of tanks appears small, tank-filling is really keeping pace with other improvements, and if another 100 of the worst tanks are filled up in the course of the next five or six years, there will not be many tanks left that are serious nuisances.

Bustees.

As regards bustee improvement it was stated last year that a register had been prepared of all the bustees in the town. This register shows that 98 bustees covering beegahs 518-2-8 are situated south of Dhurrumtollah or in Hastings. Only 80 bustees covering beegahs 352-13-14 in the four Wards 2, 5, 7, and 12, bounded by the river, 198 bustees covering beegahs 1,553-18-10 in the five Wards 1, 3, 5, 9, and 11, bounded by Circular Road, and 110 bustees covering beegahs 629-11-15 in the three Wards 6, 8, and 10 in the centre of the town.

Of these bustees the Chairman personally inspected 74 in 1881 (not including bustees casually visited) for the purpose of considering what action might be taken for their reclamation, in accordance with the classification and procedure adopted by the Commissioners for working the provisions of the Act.

The experience which the Commissioners have had of the working of sections 280 and 283 during the past year does not make them sanguine of being able to effect any very substantial improvement in the sanitary condition of bustees by this means. It is impossible to ignore the claims of private owners in the construction of roads through bustees; the road that is most needed by the owner of the parcel of land through which it passes, will rarely coincide with the road that will most benefit the entire block, and it is manifestly unjust to make one owner sacrifice himself for the benefit of another. At every step the Bustee Committee finds its projected improvements hampered by the legitimate objections of the proprietors, so that such works, as can be eventually insisted upon, fall very far short of the ideal project as first planned.

Again, the refuse which now remains in bustees unremoved, and which the opening of roads will enable the Commissioners to remove, is not by any means the greatest sanitary defect. The foul and filthy drains which intersect the bustees, full of festering sewage and manure is a far greater evil, and while little can be done to remove this under the bustee sections, there are other sections under which the Corporation have power to remedy these evils, though not without some expense. The filling up of tanks, a very important measure, can be done without resorting to the bustee procedure.

The Commissioners have no intention whatsoever of abandoning action under these sections which unquestionably lead to *some* improvements, while they enable many more to be carried out without resort to this cumbrous procedure by the knowledge that these sections remain to be appealed to as a *dernier resort* in case of necessity; but the only procedure by which comprehensive and thorough reforms can be effected is that of the new section 283-A.

It is but fair to state that many bustee-owners manifest a very creditable anxiety to improve their bustees, and anticipate the wishes of the Commissioners. Many instances have come to the notice of the Chairman during the year of bustee-owners who have carried out improvements without any coercive measures being even threatened.

Section 247 of the Act requires milkmen, cartmen, livery stable keepers and keepers of hackney carriages to take out a licence half-yearly for the places where they keep their animals, and allows the Commissioners in meeting to grant any such license subject to such conditions as they may think fit. In 1878 the Commissioners in meeting prescribed certain conditions both for hackney carriage stables and gowala bustees, and in 1880 Mr. Beverley, as acting Chairman, put this section of the law in motion with the best results as regards hackney carriage stables. The keepers of these stables were required to pave and drain them thoroughly, as a condition of obtaining a license; a few of them, perhaps, left the town, but 86 in all complied, and the improvement was very marked. Owing to the change in the Chairman this reform was not noticed in last year's Report of the Commissioners, though it was one of the most conspicuous reforms in the year. The Engineer, however, gave a detailed account of it in pages 40 and 41 of his report.

Precisely the opposite effect, however, was produced on the keepers of cow-sheds. In their case the conditions to be complied with, as prescribed in 1878, are the following:—

Every house used for the purpose of a cow-shed shall in future be raised at least 3 feet above the level of the ground, and shall allow of a space 5 feet in width and 7 feet in length for each cow stabled. The stable shall be paved with cut stones which can be supplied by the municipality, unless the stable be boarded or tiled. Each stable shall have a slope towards one side, and shall be divided by an open drain running into a cesspool 4 feet square, formed of masonry, plastered and cemented outside the stable.

No cow-shed shall be licensed if situated in a locality unapproachable by the municipal conservancy carts.

All milkmen shall be required to take out trade refuse licenses, the municipality undertaking to remove daily their stable refuse.

Gowalas may keep as much cow-dung as they may require for making fuel cakes.

The license fee required under section 247 shall be as follows:—

One rupee for twenty head of cattle, with four annas for every five above that number.

Eight annas for less than twenty head of cattle.

For animals, other than sheep, goats, or horned cattle, the maximum fee of rupees five may be imposed.

These conditions, if practicable, would effect a most marked improvement in the gowalas bustees, at present by far the filthiest bustees in Calcutta, but many of the existing cowsheds are unapproachable by conservancy carts, while the actual gowalas are, as a class, too poor to comply with the first condition.

Hence the result of the endeavour made in 1880 to enforce these conditions was a general combination of the gowalas against taking out licenses; so that it was found in June when the subject was looked into, that only two cowsheds in the town were licensed for the first half of 1881. Under these circumstances, if the cowkeepers were prosecuted, it seemed probable that they would be very leniently dealt with as the conditions were not such as they could practically comply with, and therefore after full consideration, it was thought better to waive conditions 1, 2 and 3 for all existing cowsheds that could not comply with them, at least for the year 1881. The gowalas were therefore informed by notice that these conditions would be postponed and called upon to take out licenses at once under pain of prosecution. This notice produced no effect as, after consulting with one another, they determined to keep up their combination, and prosecutions were then instituted.

Five hundred and sixty-six gowalas were prosecuted, of whom 335 were fined sums amounting to Rs. 756; the remainder were either warned only, on account of extreme

poverty, or discharged as keeping only one or two cows and not selling milk. The result of these prosecutions was that 373 cowkeepers took out licenses.

The policy being pursued in the present year is to enforce the conditions gradually, pressing in the first instance those who are in a position to comply. The taking out a license will be rigorously enforced, and a fixed time given to comply with each condition that cannot be at once conformed to. It is hoped that in this way the concert of the gowalas will be dissolved, and the requisite improvements effected by instalments.

There is one more agency at work for the improvement of bustees (described last year as the "unsystematic" agency) which certainly ought not to be ignored, that is, the serving notices on owners and occupiers to clean their bustees and compelling them to comply therewith, if necessary, by prosecutions. It would be a very great mistake to overlook the importance of this work. Few things are more patent in inspecting bustees, than that it is useless providing surface drains and other appliances for cleanliness, if the people will not make use of them when provided, and the great desideratum is to create that taste for sanitation which must underlie any great marked improvement. One of the necessary ingredients of this taste is the habit of cleanliness, and to some extent this habit can be formed by the fear of the law. It would be easy to point out many habits which can be traced to the provisions of the law strictly enforced. The residents of bustees prefer cleanliness though they will not take the trouble to secure it, and if they can be continuously coerced into taking the trouble, they will at last begin to take it spontaneously and without coercion.

Altogether 4,852 notices were served in 1881, and if all the improvements covered by them were rigorously insisted upon, and the procedure of serving notices systematised, it would soon produce very marked results. The Commissioners believe that much may be done to improve the town by careful and discriminating resort to the powers conferred on them by Sections 235–251 and by effective supervision over the work done in accordance with notices once issued, and it will be their special endeavour in the current year to give this a fair trial.

It will thus be seen that real progress is being made in sewering streets, connecting premises with the sewers, constructing new streets, converting filthy drains into foot-paths, widening and improving streets, filling up tanks, and applying the procedure of the Act to bustees; also in enforcing sanitary measures by the service of notices. Four or five years more of such improvements as have been carried out in 1881, will make a very perceptible difference in the condition of the northern part of the town. At the same time, unless these measures are supplemented by others, the Commissioners are well aware that they will be abortive. The extension of the water-supply is the most urgent of all the needs of the town, as all the improvements which are being carried out require an abundant supply of water for their successful working. A sufficient establishment of conservancy carts is also a *sine quâ non* to remove the annually increasing heaps of refuse which are being brought within their reach. Above all effectual and intelligent supervision over the Nuisance and Night-soil Departments, and the systematic enforcement of the conservancy sections of the law is indispensably requisite. These questions are under the consideration of the Special Conservancy Committee now sitting.

Water supply.

The Commissioners may congratulate themselves on water having been supplied during the year 1881 without any serious disaster. The immunity from such disasters, which the waterworks have enjoyed during the 11 years that they have been working, makes it seem superfluous to notice, at any rate in terms of self-congratulation, such an ordinary occurrence, but as a fact, there is no branch of their work in regard to which the sense of responsibility weighs more heavily on the Commissioners than the water-works. The filtered water having proved so universally acceptable, the residents of Calcutta have come to rely upon it with each succeeding year, more and more exclusively, so that a sudden cessation of the supply would now inflict the greatest conceivable hardship on almost every household in Calcutta. Yet any grave disaster to the head works at Pultah, where the water is drawn from the river, settled and filtered, any serious accident to the spinal cord of iron-piping which connects Pultah with the distributing station at Tallah, or to the machinery at Tallah, would paralyse the supply of water to the entire town.

Whether any such catastrophe, as is indicated above is likely to happen is fortunately still a matter of conjecture. Past immunity no doubt counts for much, but it should not lull the people of Calcutta, much less the Commissioners, into a sense of greater security than the circumstances of the case warrant. If year after year has passed and the waterworks have continued to do their duty, on the other hand no serious cyclone such as those which occurred in 1864 and 1867, has visited Calcutta since the

works were opened, and it must be still a matter of great anxiety to consider what the effect of such a cyclone would be.

How great the annoyance which any injury to the waterworks would inflict, may be inferred from the outcry which arose in August last when, owing to the unusually muddy state of the river, the filters at Pultah were choked, and the supply of water fell off by about 30 per cent. for a week or 10 days. This necessarily led to a scanty supply of water and to low pressure at all the hydrants, and if this caused, as it did, great discomfort even in the height of the rains, it may be inferred what the inconvenience would be if the entire supply were cut off for several days in succession. This actually had to be done for 37 hours on the 6th and 7th April, when the new independent main was being connected with the pumping station at Tallah, but the workmen worked night and day, and the people of Calcutta having been warned to lay in a supply of water, no serious inconvenience was caused.

The water once distributed from Tallah, any accident to a subsequent link in the machinery of supply would be but partial in its operation. Thus a serious accident occurred owing to gross carelessness, to the cylinder of one of the engines at Wellington Square in September. This necessitated the working with two engines instead of three at the Wellington Square Pumping Station for a whole month. It led to a decrease of pressure in that portion of the town, which is commanded by Wellington Square, for all that period, but the portion of the town commanded directly by Tallah experienced no inconvenience.

If the filtered supply suffered no serious disaster during the year, it cannot be said that it was working quite satisfactorily as regards the quantity of water supplied. Last year there was a falling-off in the average daily supply from 7,464,157 gallons to 7,407,256 gallons; this was followed in 1881 by a much greater decline, viz., to 7,298,453. Mr. Kimber attributes this partly to the 37 hours total cessation of supply at Tallah on the 6th and 7th April, partly to the choking of the filters in August and partly to a break-down at Wellington Square in September. As regards these causes, it appears that though there was a total loss of 37 hours at Tallah, the average supply in April exceeded the average supply in any preceding month of any preceding year, having risen to 7,875,537 gallons daily average. The break-down at Wellington Square, though it could diminish the pumping power of Tallah which determines the aggregate town supply, nevertheless checked the supply, because it checked its free distribution. The decrease owing to the choking of the filters, though it culminated in August, was in operation during the greater part of the autumn.

To the end of May the supply was even better than in the same five months of 1880, and exceeded a daily average of 7,680,000 gallons. In June the falling-off was rapid till it reached the lowest point in August, and it seems clear from experiments made in the end of August, that for some reason or other, the river was exceptionally charged with silt at that time and very probably throughout the rains of 1881.

The only important new work undertaken during the year in connexion with the filtered supply, was the laying down of the independent main between Wellington Square and Tallah, to enable the reservoir at the former to be filled during the night, without utilising the ordinary street pipes. It was found that 500,000 gallons disappeared nightly by this channel, mainly owing to leakage and waste, partly perhaps to water being taken during the night. This loss is now obviated. Still it cannot be denied that the supply is very insufficient and is daily becoming more so. 13,386 premises in the town are now connected, and the new connexions during the year amounted to 637. As premises are connected, the demand for water increases; careful experiments were made during the year to estimate the effect of connexion on consumption of water, and though the results must not be taken as more than approximate, they led to the inference that persons living in connected houses consume over 25 gallons a head per diem, while persons living in unconnected houses, who have the trouble of going to the hydrants to fetch their water-supply, consume only 5 gallons a head. If 600 new premises containing say 9,000 persons are connected annually, this means an increased demand of $9,000 \times (25 - 5) = 180,000$ gallons daily with each succeeding year. Moreover, the length and cubical content of the sewers is yearly being increased, these also require a more liberal water-supply to keep them in good order. It is therefore evident that too much importance cannot be attached to the urgency of increasing the Calcutta supply of water.

The evil, however, will be alleviated to some extent, when the arrangements now in progress for increasing the unfiltered supply are completed, as it is hoped they will be in the course of the current year. The average daily supply of unfiltered water in 1881 was 1,257,300 gallons which was 91,524 per diem more than in 1880. The new

engines are to be capable of pumping 2,000,000 gallons in six hours, and therefore by working 12 hours they will be able to supply 4,000,000 gallons, an amount considerably in excess of the entire wants of the town and Esplanade. It will therefore be possible to save nearly all the filtered water now used in watering the street estimated at 700,000 gallons per diem, and nearly all the filtered water used at latrines and night-soil depôts, estimated at 400,000 gallons. A million gallons per diem added to the present consumption of filtered water for household purposes will, to a very appreciable extent, meet the growing wants of the town for the next five or six years, *i.e.*, till 16,000 or 17,000 premises are connected.

Moreover, there are about 3,000 privies at present connected with the sewers, which are supplied with filtered water consuming, perhaps, 300,000 gallons daily. By Section 134 of the Act, the Commissioners have the power at their own expense of replacing this with the unfiltered supply. So that before the end of the current year, it may be hoped that the Commissioners will be in a position to set free about a million gallons per diem of filtered water for ordinary household consumption, susceptible of being increased at their option to 1,300,000 gallons. The benefit, however, will not stop here; the streets will be more liberally watered than at present, the latrines and night-soil depôts more liberally supplied, and new privy connections, which are not now permitted, can be again sanctioned: whilst the sewers which now only receive from the waterworks about 8½ million gallons a day to assist in flushing them, will receive from the same source over 10 million gallons a day.

The Water Analyst describes the quality of the water in the following terms:—

The system of analysis carried out during the year 1881 has been the same as that followed during the previous five years. Two methods of analysis are made use of, the first a partial analysis which is performed twice in each week, and the second a full and complete analysis which is made at the commencement of each month.

The results of the partial analyses, are given in the following table:—

	Number of Days on which Analyses were made.	Number of Days of Analysis when Water was Colourless and Transparent.	Number of Days of Analysis when Water was Opalescent, *i.e.*, when Filtration was not perfect.	Chlorine (representing Dissolved Sodium Chloride, &c.) in One Million Parts of Water.	Total Ammonia (representing Nitrogenous Organic Matter) in One Million Parts of Water.
1st quarter 1881	26	26	—	12·04	0·021
2nd do.	27	26	1	12·01	0·015
3rd do.	26	—	26	6·31	0·010
4th do.	26	23	3	6·02	0·011
Average for whole year 1881	103	76	30	9·10	0·015
Do. do. 1880	103	74	29	9·49	0·030
Do. do. 1879	103	91	12	8·50	0·035
Do. do. 1878	103	75	28	8·37	0·034
Do. do. 1877	104	72	32	10·40	0·046
Do. do. 1876	155	137	18	10·65	0·037

On comparing the average numbers for 1881 in this table, with those of the previous years, they will be found to agree very closely in all cases except in the last column. So far as this method of analysis would show, it would appear that the water delivered in 1881 was of about the average quality, with the exception that the amount of nitrogenous organic matter contained in it was decidedly smaller. This last fact is shown by the column "total ammonia," and the amount of this substance found in 1881 was only 0·015 parts per million, as compared with an average of 0·036 parts as contained in the water of the previous five years.

This table also gives information as to the filtration of the water during the year, and from it may be seen that the filtration was imperfect on one day in the second quarter, and on all the days of analysis during the third quarter of the year. It will be also noticed that this is about the average result as found in the years 1880, 1878, and 1877, so that in respect to filtration, the condition of the water was very satisfactory. The table, however, gives no information as to the amount of the opalescence or turbidity, and although the water was thus reported imperfectly filtered during the rainy season or for three months of the year, yet the amount of opalescence was so slight, that, in the majority of instances, it would have escaped detection unless it was specially looked for. So far as can be judged, the water of 1881 was, if anything, rather better filtered than in previous years.

The next table contains the results of the full and complete analyses of the hydrant water made at the commencement of each month. The numbers obtained in each month are there given together with the average for the whole year, and the average numbers obtained in the three previous

years; there is also added for the sake of comparison, the average composition of all the waters supplied to London and the Suburbs for the first half of 1877.

Date of Collection of Sample.	Description of Colour, Transparency.	Total Solid Impurity.	Organic Carbon.	Organic Nitrogen.	Ammonia.	Nitrogen as Nitrates and Nitrites.	Total Combined Nitrogen.	Chlorine.	Hardness. Temporary.	Hardness. Permanent.	Hardness. Total.
1st January 1881	Colourless and transparent.	17·32	·133	·052	None	Traces not measureable.	·052	1·10	3·10	3·90	7·00
1st February "	Do.	24·40	·083	·059	None	·028	·087	1·23	5·61	3·25	8·86
1st March "	Do.	23·50	·087	·056	None	·009	·065	1·28	5·58	2·99	8·57
1st April "	Do.	24·10	·101	·057	None	·018	·075	1·21	6·10	2·47	8·57
1st May "	Do.	20·16	·095	·058	None	Traces only	·058	1·31	4·13	2·99	7·14
1st June "	Do.	22·14	·089	·041	None	Do.	·041	1·14	3·00	4·71	7·71
1st July "	Slightly opalescent and yellowish.	13·46	·115	·032	None	·023	·055	0·82	2·62	4·57	7·09
1st August "	Do.	19·04	·075	·036	None	·062	·098	0·60	1·29	4·71	6·00
1st September "	Do.	10·30	·063	·054	None	·025	·079	0·60	1·72	6·14	7·86
1st October "	Almost colourless and transparent.	10·92	·074	·076	None	Traces only	·076	0·60	3·23	5·86	9·14
1st November "	Colourless and transparent.	11·68	·280	·079	None	Do.	·079	0·53	5·18	2·90	8·14
1st December "	Do.	16·16	·073	·032	None	Do.	·032	0·71	4·53	3·90	8·43
Average for year 1881		16·87	·135	·053	None	·014	·067	0·94	3·84	4·04	9·71
Do. 1880		17·03	·250	·045	None	·044	·089	0·98	4·04	3·04	7·08
Do. 1879		17·04	·197	·052	None	·016	·068	0·87	3·25	5·53	6·78
Do. 1878		17·30	·111	·054	None	·023	·077	0·87	2·21	2·91	5·13
Average composition for first six months of year 1877 of all water supplied to London and its suburbs		31·00	·160	·024	None	·328	·352	1·80	—	—	19·73

The numbers given in this table for the past year are strictly accurate with the exception of the columns "organic nitrogen" and "organic carbon." The numbers given in these two columns are not so trustworthy on account of the difficulty of obtaining accurate results in the foul atmosphere of the Corporation laboratory. This fact was, however, reported in special communications in 1880 and 1881, and also in the annual report for 1880. Taking the other columns into consideration, it may be seen that the water delivered in 1881 was of about identical composition with that of the previous years. In the case of the organic carbon and nitrogen, however, the numbers given would tend to show that the water of 1881 was decidedly more contaminated with organic matter than in previous years. This, it will be seen, is the reverse to what was found by the partial method of analysis, but in the latter case the results would not be affected by a foul atmosphere as the former process is. It is therefore impossible to criticise the analytical numbers with any degree of certainty, but it may be safely stated that the hydrant water delivered in 1881 was a pure and wholesome supply, and probably of a purity quite equal to that of former years.

Drainage.

The following shows the progress made during the year in completing the drainage of the town:—

	First Class Sewer Miles.	Second Class Sewer Miles.	Third Class Pipe Sewer Miles.
Total work as originally estimated	10·78	23	154
Complete to end of 1880	10·78	23	118·73
Balance uncompleted on 1st January 1881	—	—	35·27
Carried out in all 1881	—	—	14·15
To be done in 1882 and subsequent years	—	—	21·12

The balance, as the Engineer points out in his report, is somewhat below the mark, as the 154 miles include a lump estimate for sewers in ditches which were only computed from Simms' map, and not from actual measurement. This estimate has in many cases proved inaccurate, generally by way of defect, as branches and continuations of the ditches which it was found necessary to sewer, were not shown in the map. At the same time Mr. Kimber points out that this will not involve any serious addition to the estimate. The drainage of the town is therefore now fast approaching completion, and it may reasonably be hoped that by the end of the year 1883 the work will be concluded.

The cultivation of the land reclaimed by the deposit of sweepings at the Salt Water Lakes, is watched by the Commissioners with much interest. The lessee Baboo Bhobonath Sen is an energetic man, and does justice to the experiment which he has undertaken. All the conditions as regards soil and manure are excellent, but his great obstacle at present lies in the swarms of rats, pigs, and carrion birds that are attracted to the spot. Sometimes his labour and those of his ryots are rewarded by a splendid crop,

on other occasions just when the promise is best, the crop is destroyed by vermin. The nuisance caused by the skining platform, which is situated at the entrance to the municipal land, is also very great, but this is the last year of it, as arrangements have now been completed to remove it to a more distant site.

Conservancy.

The Conservancy establishment labours under great difficulty. Though complaints are frequently received of the neglect to remove refuse, especially in the northern part of the town, and though in many of the bustees no conservancy arrangements are practicable for the removal of refuse, still the figures given in the Engineer's report show conclusively that year by year more and more is accomplished, and while the population of the town is known to have remained practically stationary, the amount of refuse removed has increased by more than 50 per cent. in the last four years.

The cleansing of sewers was well attended to during the year as shown by the fact that the cart loads of deposit removed from the gully-pits aggregated Rs. 10,806 against Rs. 7,463 in 1880, and an annual average of Rs. 7,689 in previous years. The constant increase in the length of sewers manifestly tends to an increase in the silt to be removed, but the large increase over 1880 is also due to the rain-fall having been much more abundant in that year.

ABSTRACT OF REPORT OF THE HEALTH OFFICER FOR CALCUTTA FOR 1881.

(*Dr. K. McLeod.*)

The number of births registered during the year fell short by 94 of the total registered in 1880, and exceeded the average of the preceding decade by 1,280. The improvement manifest in the figures of 1880 is therefore practically sustained but not advanced. The figures of 1881 present the same peculiarity in respect of excess of births in the cold months, which those of the previous year and the decennial mean exhibit. This feature is possibly due to the population of the town being larger in these months. Of this, however, I possess no statistical evidence. Vital statistics.

Statement of Births registered in Calcutta from 1871 to 1881.

Years.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	Ratio per 1,000 of population Census 1881.
1871 - - -	448	344	350	419	368	348	387	409	503	566	569	476	5,169	11·9
1872 - - -	549	349	455	346	340	305	333	390	396	397	395	326	4,564	10·5
1873 - - -	294	338	354	372	354	300	369	456	478	437	500	499	4,538	10·6
1874 - - -	452	394	548	317	369	343	394	408	392	450	420	456	4,663	10·7
1875 - - -	415	334	393	778	606	570	569	633	650	720	727	606	7,601	16·4
1876 - - -	498	500	576	541	509	566	694	665	710	705	769	719	7,452	17·2
1877 - - -	570	552	588	706	427	491	647	648	709	708	661	755	7,457	17·2
1878 - - -	638	530	611	550	526	489	496	607	573	658	640	612	6,925	15·9
1879 - - -	482	464	450	428	458	430	410	497	604	668	728	795	6,409	14·7
1880 - - -	549	501	591	556	580	580	620	583	668	766	774	784	7,552	17·4
Mean of 10 years -	488	415	471	500	453	442	491	529	562	604	614	602	6,178	14·2
1881 - - -	661	620	599	595	492	548	584	568	605	706	750	730	7,458	17·2

The rate of 17·2 per 1,000 of population, which the returns of the past year render, has been calculated on the figures supplied by the census of the town taken on the 17th of February 1881. These figures have been employed as the basis of calculation in all the statements and returns contained in and appended to this report, previous ratios being left undisturbed. The differences between the census of 1876 and 1881 are so inconsiderable as to render adjustment of the population for intervening years unnecessary. In discussing the vital statistics of the town for the year under report, I shall have occasion frequently to refer to the excellent report on the census of 1881, prepared by Mr. H. Beverley, C.S.

One of the subjects specially discussed by Mr. Beverley is the probable accuracy of the birth-rate of Calcutta. He points out that the disparity between the sexes in Calcutta makes any comparison with towns where the sexes are more equally balanced, or the female population in excess, fallacious. On the other hand, the proportion of married females appears to be higher in Calcutta than in English towns, and it is a well-established statistical law that the higher the proportion of married females, the higher the birth-rate. Making allowance for these two circumstances—the excess of males on the one hand and of married females on the other—Mr. Beverley finds that 24 per 1,000 would be an approximately correct rate for Calcutta according to European standards, and concludes that the registered statistics of births in Calcutta are still very imperfect. It is possible, however, that the proportion of married females (61·4) is overstated, and that the average family is not so large as in England.

The number of children under one year of age found alive in Calcutta on the 17th of February 1881 was 6,087. There were born in the town during the year 7,458, and 2,577 children under one year died. Roughly, therefore, the number of living children should be 4,881, or 1,206 fewer than were actually discovered by the census. It is

improbable that a mistake of this magnitude crept into the census, or that so large a number of children born elsewhere are annually brought into Calcutta during the first year of their life. It seems certain, on the whole, that birth registration is still not quite what it should be, but I am inclined to believe that its results are not so far below the truth as a superficial comparison with European standards would indicate. I hope to be able in time to test the accuracy of the registration figures through the agency of the Vaccine Department; meantime the birth returns must be accepted with reserve.

The death-rate of 1881 is somewhat in excess of the decennial average, and holds the fifth place in the series of 11 years—1871–81. The statistics of the year are favourable as regards bowel complaints, fevers, and small-pox, and unfavourable as regards cholera and "other causes." There was an epidemic of measles in the hot-weather; but with this exception the town has been very free of infectious disease. The following table presents the main facts of the year in comparison with the previous decade. The returns representing mortality may be accepted as correct in so far that very few, if any, deaths occurring within the precincts of the town escape registration; but in a floating population consisting largely of adult immigrants, very many persons seized with mortal illness are removed to end their days elsewhere. This circumstance renders the death-rate of Calcutta fictitiously favourable.

Statement of Deaths from the most Prevalent Diseases from 1871 *to* 1881.

Years.	Cholera.	Diarrhœa and Dysentery.	Fever.	Small-pox.	Other Causes.	Total.	Ratio per 1,000 of Population. Census of 1881.
1871	796	1,488	4,242	33	3,730	10,289	23·7
1872	1,102	1,365	4,895	18	2,972	10,352	23·8
1873	1,105	1,351	4,632	33	3,235	10,356	23·8
1874	1,245	1,358	4,461	120	4,343	11,527	26·6
1875	1,674	1,579	5,328	720	4,785	14,086	32·5
1876	1,851	1,864	4,861	71	4,817	12,964	29·9
1877	1,418	1,683	5,151	67	5,385	13,704	31·6
1878	1,338	2,010	6,086	1,495	5,467	16,396	37·8
1879	1,186	1,516	4,796	772	4,774	13,044	30·1
1880	805	1,267	3,797	814	5,698	11,681	26·9
Mean number	1,252	1,548	4,774	344	4,520	12,439	28·7
1881	1,693	1,491	3,765	133	5,948	13,030	30·0

In dealing with the particular diseases which have been assigned and registered as causes of mortality, it is necessary to state that the statistics of the town must be accepted in this respect with very great reserve. The recognition of the diseases causing death depends in many cases on exact diagnoses made by skilled medical practitioners; but in the majority of instances the identity of the disease is very doubtful as the information has been furnished by ignorant relatives according to their own vague notion of what the fatal malady was. Even as regards the four principal groups of death causes which have been specified in many of the tables embodied in this report—cholera, small-pox, fevers and bowel complaints—the figures are somewhat indefinite. The return of cholera is perhaps the most accurate, because the disease is a very striking one, and not easily mistaken for any other. Deaths from chicken-pox and other eruptive diseases doubtless find a place under the term small-pox. Fevers certainly include many fatal diseases in which fever is a mere phenomenon or symptom, and the same remark is applicable to fatal fluxes. The elaborate tables appended to the report are to be accepted as rather an effort towards refinement and completeness of detail in the future than as a true representative of present death causes.

Vital statistics relating to the Suburbs are probably entitled to less reliance than those of the town, particularly as regards registered death causes. Still as they are more likely to err by defect than excess, and as the four main groups of death causes referred to in the last paragraph are probably approximately correct, the following table is introduced for comparison with the figures of Calcutta. The higher death-rate of the Suburbs is a striking and indisputable fact. The death-rate of 1881 was 44·3 per 1,000 of population, against 30 for the town, representing an excess of nearly 50 per cent., which accords closely with the experience of past years.

Suburban Deaths in 1881.

Months.	Cholera.	Small-pox.	Fevers.	Bowel Complaints.	Other Causes.	Total.
January	95	4	511	198	317	1,125
February	122	16	394	134	227	893
March	341	18	417	104	205	1,085
April	343	7	360	96	197	1,003
May	85	6	316	104	193	704
June	36	1	286	61	164	548
July	35	—	315	92	206	648
August	70	1	417	88	224	800
September	79	2	309	98	209	697
October	103	1	410	111	279	904
November	234	—	592	153	295	1,274
December	336	—	622	237	267	1,462
Total	1,879	56	4,949	1,476	2,783	11,143
Ratio per 1,000 of population	7·4	·22	19·6	5·8	11·6	44·3

Cholera.

Although the prevalence of cholera in 1881, as indicated by the registered mortality, does not transcend the limits of the more favourable years commencing with 1870, and presents a marked contrast with the years preceding that, still the results are far from satisfactory. The aggregate of deaths is a little more than twice as large as that of 1880, and the mean of the preceding decade is exceeded by 441; 1881 takes its place among the worst years of the series of reduced cholera. The suburban mortality from cholera was as usual, higher than that of the town, the ratios of deaths to population being respectively 7·4 and 3·9. It is noteworthy that the percentage of increase in the suburbs was 91 against 110 for the town.

The cholera ratios of 1881 follow generally the rule of the preceding decade, and the few departures from the rule may be viewed as fluctuations due to small numbers.

The figures also sustain the general experience of the year, that the disease was distributed sporadically throughout those parts of the town habitually prone to it, and that no localization or spread of an epidemic kind became manifest. The same tendency to grouping around foul tanks and filthy wells was observed as in former years; but the only instance of anything approaching a demonstration of the determining influence of fouled air and filthy water which came under notice was the following remarkable occurrence, whose incidents I carefully investigated at the time, and shall place on record as a good illustration of the circumstances under which localization of the disease is apt to occur in Calcutta.

Seth Bagan is a dense collection of tiled huts, surrounding two very filthy tanks situated a little to the east of Upper Chitpore Road (No. 85). In the hot weather of 1880 I inspected the place carefully and drew attention to several glaring sanitary defects which I observed—more particularly, the foul tanks, general uncleanliness of the *bustee*, and the filthy drains loaded with organic impurity pervading it. Improvements had been commenced when the events which I am about to relate transpired. Cholera had not broken out in the village or its neigbourhood up to this time, though some 27 deaths had occurred sporadically in the Jorasanko Section. On the 26th of March some sweepings were, through a mistake of the Conservancy Department, thrown into the more southerly of the two tanks, which had not been previously de-watered. The villagers went on using the water for bathing, washing dishes, &c. A fatal case of cholera occurred in a hut on the immediate west of the tank on the 28th, and an old woman died of purging in another hut close by on the same day. Another death from cholera happened in a hut to the south-west of the tank on the 2nd of April. On the 5th of April a quantity of putrid dall, which had been condemned by me, was, through a mistake of the Conservancy Department, thrown into the tank. This material exhaled a foul stench, but the people still went on using the water. Cholera seizures occurred on the 6th, 7th, and 8th in the hut next to the heap of putridity, resulting in four deaths. Another case occurred to the west of the tank which recovered. Thus eight cases, of which seven proved fatal, broke out on the borders of this hollow immediately or shortly after these putrid materials had been thrown into it. Two deaths subsequently took place in another part of the village on the 16th and 18th of April near a foul drain which was in process of being piped.

The evidence now recorded is not demonstrative, but it amounts to a very high probability that the filth deposited in this tank was the exciting cause of the outbreak in

Seth Bagan either through the medium of the air or water. I investigated several other cases during the year in which filth and cholera were intimately associated, but none so clear as the above. On the detection of the outbreak and the circumstances associated with it prompt steps were taken to empty the tank and disinfect the putrid heap. The tank has now been filled up, the drains piped, and the village generally improved; and since the events described no report of unusual sickness or mortality has reached me.

Bowel complaints.

The mortality from dysentery and diarrhœa was below the average, but above that of the previous year. The seasonal fluctuation of these diseases follows the rule of fevers rather than cholera, exhibiting a well marked cold weather maximum and rains depression, and an intermediate gradual elevation and depression. When cholera is rising in spring, fevers are falling. The term indeed covers a complex group of diseases, some, perhaps, allied to cholera, most, probably, associated with fever, and discussion of figures relating to a term of this kind would, without an analysis, which is not available, be unprofitable.

In the Suburbs, the year was comparatively favourable as regards bowel complaints, and it will be observed that the seasonal flow and ebb accord with that of the town. The suburban death-rate is 5·8 against 3·6.

Fevers.

The year was exceedingly favourable as regards fatal fevers, the total being below that of any year of the preceding decade. In the Suburbs also a great abatement took place from the very high figure of the preceding year. The suburban fever-rate was 19·6 against 8·6 for the town—more than double. The seasonal fluctuation in both cases was normal, the minimum being in June and the maximum in December; intermediate months exhibiting a gradual rise and fall. The varieties of fatal fever, defined in the return as typhus (four deaths), enteric or typhoid (569), simple continued (1,825), ague (48), and remittent (1,318). The numbers entered under these heads are, in the absence of accurate diagnosis, subject to great doubt.

The large number of deaths registered under the head of "enteric or typhoid fever," namely 569, would indicate that this disease is a very prevalent and fatal disease in Calcutta, but I am inclined strongly to doubt the accuracy of the figures. Two hundred and seventy-six of the deaths entered under this head occurred among children in the first year of life, and 515 under five years of age; leaving a balance of 54 for all the remaining ages. This is contrary to experience. The following statement brings out clearly the anomalies of the Calcutta figures:—

	London, 1879.	Calcutta, 1881.
Deaths per 1,000 - - - -	·23	1·3
Deaths under one year per cent. of total deaths	1·8	48·5
Deaths under five years per cent. of total deaths	14·6	90·5

Taking the statistics of Christians (European and Eurasians) the deaths registered under typhoid fever are only nine in number, equal to ·39 per 1,000 strength, and of these not one occurred under 20 years of age. It is among the Hindus and Mahomedans—indigenous races which army statistics prove to be less prone to typhoid—that the large numbers and high rates appear.

The experience of the hospitals is opposed to the idea that typhoid fever is a common disease in Calcutta, or on the increase.

I have further ascertained that in the garrison of Fort William only one case of typhoid fever has occurred during the last seven years, although the admission rate from the disease has been as high as 11·5 per 1,000 among the European army of Bengal, and the death-rate 4·6.

If the influences causing enteric fever were rife in Calcutta, the European soldier, so prone to succumb to these in other stations, would inevitably contract the disease.

The general inference deducible from these facts and considerations is that typhoid fever is not a formidable cause of sickness and mortality in Calcutta, and there is no reason whatever to suppose that the disease has arisen or increased in the town with the construction and development of an underground system of drainage and sewerage. I have, in a tolerably extensive practice, met with but one case of typhoid fever, and other medical practitioners have communicated to me a similar experience.

Small-pox.

The mortality from small-pox has been moderate, and the year takes its place in this respect among those in which this disease prevails sporadically rather than epidemically. The registered deaths took place during the first six months, only two casualties having been recorded in the last six.

Vaccination

The system of vaccination, initiated in 1880, has been seduiously worked. The old system of domiciliary vaccination is still followed to a great extent, but the people are being gradually trained to resort to the public stations or to apply there for home vaccination. Considerable assistance has been derived from the registration of births, but greater benefit from this aid will be reaped in future years, for the period allowed by the law only began to lapse towards the close of the year under report. Only one prosecution has been as yet found necessary and the most obstinate *itcha* families are induced to yield to persuasion and judicious pressure.

The total of operations has been a little less than that of 1880 (6,538 against 6,747); however, the number of primary vaccinations has been higher (5,523 against 5,349). The amount of infant vaccination is about the same and the ratio of success good. The work of the year, though contrasting favourably with previous non-epidemic years, is far short of the requirements of the town.

Sanitation.

There can be no doubt or question that the sanitary state of the town, though in many respects greatly improved, is still most unsatisfactory. The progress of road making and drain piping results every year in a palpable reduction of uncleanliness and in increasing facility of filth removal. During the year under report this good work has been actively pushed, and to many fœtid *bastees* has been granted access of air and conservancy carts, while many stagnant ditches reeking with foul putridity have been obliterated, and their place occupied by clean paths beneath which glazed pipes convey to adjacent sewers the materials which formerly festered and stank. Tank-filling has also been actively prosecuted as agency and material have become available. 24 of these filthy hollows, in addition to 47 wells, were reported during the year as having had cases of cholera in their immediate vicinity. The number of tanks filled up during the year amounted to 21.

In order to test the quality of the soil-water of Calcutta and demonstrate the impossibility of obtaining anything like safe drinking or cooking water out of hollows dug in Calcutta soil, I caused three trial-wells to be sunk in three bustees, and the water obtained from them to be analysed. The results of the experiment are shown in the following tabular statement:—

Locality.	Sqortee Bagan.	Mitter's Lane.	Putwar Bagan.
Description of well	Dug on 12th February in the centre of the bustee in a clear square adjoining a road. Houses about 15 or 20 feet distant. Privies and open drains in the vicinity. Well about 15 feet deep. Water 12 feet from surface. Soil, clay and gravel for 8 or 10 feet; sand below. No tank in neighbourhood.	Dug about the same time in an open spot about 300 feet square. Houses on three sides, a large tank on the fourth. Well about 15 feet deep. Water 10 feet from surface. Soil clayey for 6 feet. Sand and clay mixed below that.	Dug about the same time. Open spot 12 feet from a lane. Houses about 15 feet distant. A filthy surface drain about 15 feet off. Well 13 feet deep. Water 8 feet from surface. Soil clay mixed with sand.
Physical characters of water.	Blackish colour; rather opalescent. Contained a small quantity of suspended matter and some animal life. Gave out a most offensive smell.	Slight yellow colour. Contains a trace of suspended matter and some animal life. Gave out a faint unpleasant smell.	Slight yellow colour. Contained a little suspended matter and some animal life. Emitted a slightly unpleasant smell.
Chlorine in parts per million.	663·85	603·5	798·75
Total ammonia in parts per million.	91·0	2·4	6·246
Remarks	Examined 9th March	Examined 23rd March	Examined 3rd May. Ammonia had probably escaped.

The analyses were made by Mr. A. Pedler, analyst to the corporation. It is clear that water obtained by digging in the soil of Calcutta is quite unsafe and unsuitable for domestic purposes of all sorts. The filling up of tanks and wells constitutes, therefore, one of the main sanitary requirements of Calcutta. Some complaints were made regarding the use of road sweepings for this purpose, and in one case a prosecution was instituted on the score of nuisance caused to the neighbourhood in this way. Better material is very expensive and hard to get. Strict rules have this year been laid down regarding the mode of filling up tanks with sweepings so as to minimize offence. But the temporary inconvenience of the process constitutes an infinitely smaller risk to health than the use of the poisonous fluid contained in these hollows involves.

Since the close of the year a special committee of the Commissioners has been appointed to take into systematic and detailed consideration the question of improved appliances and increased establishment for the removal of filth. The earnest and practical manner in which the business of this committee is being conducted gives encouraging promise that important sanitary reforms will result from its deliberations.

The quality of water supplied to the town continues to be satisfactory. The need of a larger supply has forced itself on the conviction of the Commissioners, and the question of how to accomplish this with the greatest possible economy and without sacrifice of purity is at present under consideration. Measures are meantime in progress for increasing the supply of unfiltered water. This will make a sufficient quantity of water available for such important sanitary purposes, as flushing drains, watering roads, &c., and will liberate for domestic use a considerable amount of filtered water which is now being used for these purposes.

ABSTRACT OF REPORT OF THE MADRAS MUNICIPALITY FOR 1881.

(*Mr. A. T. Arundel.*)

Drainage.

The diversion of sewers from the Cooum and the canal has been steadily kept in view. The diversion of the large sewers opposite the Salt Cotaurs and by Elephant Gate Bridge, begun in 1879, was completed in 1880. Two smaller sewers that pass under the railway and fall into the canal were also diverted. Two drains near Colonel Law's Bridge were diverted from the Cooum and used to irrigate grass-beds in the Napier Park. A seventh large sewer was similarly diverted and utilised in the People's Park, and an eighth was diverted from a filthy tank at the end of Sydenham's Road. In another year or two it is to be hoped that the Cooum will be freed from all sewage except what is brought in during heavy rains, and its general condition greatly purified.

The Commissioners having approved the scheme of the Vice-President, Mr. Jones, for the drainage of Black Town, which had also been accepted by Government, resolved to sanction the raising of a loan of Rs. 1,00,000 to commence the work. It was at first arranged that the municipality should purchase the harbour works engines for which it was supposed that there would be no further need. The cyclone of November showed that the engines would still be required for the harbour itself. It therefore became necessary to purchase new engines from England, and accordingly Messrs. Gwynne and Co., who are providing the centrifugal pumps for lifting the sewage, also received orders for the engines to drive the pumps. The municipality are the gainers by this arrangement as the harbour engines would have needed considerable alterations and increasing charges for repairs. The sanction of Government to the raising of the loan was received in December, but the loan was not raised in the year under report.

The extensive deposit of sand caused by the harbour works greatly increased the nuisance caused by the discharge of the main drain north of the Fort, for the mouth of the drain was above 230 feet from the sea, and the sewage had to flow this distance over the sand to make its escape. At a meeting on the spot with Colonel Sankey, Colonel Ross Thompson, Mr. Thorowgood and the Vice-President, it was resolved to recommend, for the approval of Government, Mr. Jones' scheme of extending the main drain to the sea. The Government sanctioned the proposal and allotted Rs. 13,600 to carry it out.

Water supply.

At a meeting in the month of September the Commissioners determined to complete as far as possible the distribution of the Red Hills water throughout so much of the area of the city as was intended to be supplied, and for this purpose they sanctioned the raising of a loan of Rs. 2,50,000, a sum which, it was estimated, would complete the work. Preliminary arrangements were made to carry out the work, and the sanction of Government was received in December, but the loan was not raised till the ensuing year.

A granite fountain was erected in Pycroft's Road for the use of the public by the liberality of M.R.Ry. P. Annamalai Chetty. Forty-one hydrants were fixed to supply water against fires and for watering roads and trees, and 10 new fountains were set up.

The supply from the Red Hills Lake was maintained throughout the year except on the 3rd and 4th July, when the supply was shut off to clear the channel of weeds. The quantity of water drawn off from the lake into the delivery channel was 4,839,592 cubic yards for which payment has to be made to Government at the rate of one rupee per 1,000 cubic yards.

In order to check with accuracy the amount drawn off, a self-acting clock-work gauge was ordered from England, but was not received during the year under report. The water drawn off represents a consumption of 11¼ gallons per day for 200,000 persons.

Conservancy.

The cost of this most important of municipal duties (Conservancy) was Rs. 2,19,806. One thousand and seventy-nine coolies and 532 carts were maintained, besides four large canal barges for the removal of rubbish and filth of all kinds. Three hundred and fifty-three thousand seven hundred and eleven cart-loads were thus removed, besides about 20,000 tons of night-soil. The Conservancy staff is inadequate, and a complete system for the cleansing of privies and latrines throughout the town is much needed. Financial difficulties are the sole impediment.

Great improvements have been effected in the Tinnevelly Settlement and Nagatha Covil Parcherries. These places, and particularly the former, were the most loathsome and filthy quarters of the town. The latter has been entirely removed. Through the former have been driven lanes and streets, some parallel to each other checkerwise, laying the place thoroughly open to inspection and sanitation. A small conservancy staff was attached. As the Vice-President remarks, one result has been the immunity of this place from cholera during the recent outbreak, though it was specially attacked before.

Health of Madras.

The birth-rate per 1,000 was 40·3 as compared with 40·4 in 1880, 41·8 in 1879, and 37·9 in 1878. The total number of births was 16,025 as compared with 16,077 in 1880. The percentage of male births to female was as 50·8 to 49·2. I do not yet feel satisfied as to completeness of the registration of births.

The death-rate was 38·9 against 37·4 in 1880, and 34·7 in 1879. The total number of deaths was 15,487, exceeding those of 1880 by 580. The cause was the prevalence of small-pox, measles, and fever, as the following brief statement shows:—

	1880.	1881.	Increase.
Deaths from small-pox - -	869	1,654	785
„ measles - -	105	299	194
„ fevers - -	3,549	3,698	149
„ cholera - -	2	126	124

The first attack of cholera occurred in the month of September, and was believed to have been imported from the great concourse of pilgrims at Upper Tripatty in North Arcot. Special arrangements were at once made in the Conservancy Department for an increased number of carts and scavengers, and for other requisites for improved sanitation in the places attacked. A complete history of the attack must be reserved for the following year, when it passed away.

Vaccination.

The total number of cases vaccinated was 30,908 against 25,066 in 1880. The successful cases were 27,643, the unsuccessful 1,960, while 1,305 were not traced. The number of infants under one year vaccinated was 8,798 as compared with 8,172 in 1880. The number of vaccinations under one year as compared with the number of births is as follows:—

	No. of Births.	No. of Vaccinations under 1 year.
Europeans and Eurasians -	490	359
Hindus - - -	12,495	7,392
Mahomedans - -	1,813	949
Others - - -	678	98
Total -	15,476	8,798

It thus appears that only about one-half of the children born in Madras are protected against small-pox within a year of birth.

With regard to general results, 17,894 males were vaccinated, and 13,014 females, a proportion which is perhaps as good as could be expected. The Commissioners at a meeting in August resolved to require a certificate of protection against small-pox from every child brought up to be examined for educational result grants, but the rule did not come into operation before the close of the year.

The number of deaths from small-pox during the year was 1,654, as compared with 869 in 1880. It is much to be desired that vaccination be made compulsory as approved by the Commissioners in their resolution of the 28th November 1879. The Government were specially addressed on this subject in the course of the year, but no decision has been received.

ABSTRACT OF REPORT OF THE BOMBAY MUNICIPALITY FOR 1881.

(*Mr. E. C. K. Ollivant.*)

Among the principal sanitary works in progress during the year were the construction of new main sewer from Carnac Bridge to Love Grove, new outfall sewer from Love Grove to the sea, new pumping station at Love Grove, pipe sewers in connection with the new main sewer, raising of Tulsi dams, construction of the Bhandarwada reservoir, and new milch cattle stables at Agripada. Sanitary works.

The new main sewer, in length 4¼ miles, was brought to a satisfactory completion on the 1st June, about 17 per cent. of the whole work having been executed during the year. The outfall sewer was also completed, about half the work having been done in the year under report. Unfortunately just before the monsoon there was an unusually heavy sea, which resulted in the displacement of the rubble and concrete covering for a length of 192 feet, but the pipes were uninjured. The foundations of the new pumping station had been completed before the close of the year, and Mr. Walton confidently anticipates that the new engines will be working at the end of this monsoon. The progress of the pipe sewer work was very unsatisfactory, and there was occasion to find frequent fault with the contractors for dilatoriness. Out of rather more than 23¾ miles of pipe about 16¼ had been laid by the end of the year.

Similar complaints have been made with reference to the contractors entrusted with the construction of the Bhandarwada reservoir. At the end of the year 66·7 per cent. of the contract time had expired, but only about 36·3 per cent. of the work had been completed. There have to a certain extent been unexpected difficulties, but with every allowance for these the slow progress made by the contractors cannot be justified, and, as it is of the greatest public importance that the reservoir should be available for use as soon as possible, it will now be a question whether the contract must not be taken out of their hands.

The dams of the Tulsi Lake were raised 6 feet before the monsoon, and at the close of the monsoon the level of the lake was 2½ feet higher than at the same period of the previous year, and nearly 2 feet higher than it could have been if the dams had not been raised. The additional storage thus obtained is calculated at 234 million gallons, less than half the increase which it was hoped the raising would secure. But the rainfall was only 86·11 inches, or 15·32 less than the five years' mean. The cost of the work was Rs. 69,621.

A new milch cattle stable was in course of construction, and this has since been completed. Provision for the further extension of similar accommodation has been made in the Budget for the current year. But this is not enough. The municipality cannot be expected to build cattle stables sufficient for the wants of the whole city, and little will be gained by getting rid of ill-constructed stables in one quarter, which are without drainage and proper water-supply, only to find them re-established in a like condition in another. Proprietors of stables must be compelled themselves to build in accordance with sanitary regulations if cattle are to be kept in the city at all, and it may be worth while to allow a certain quantity of water free, or at very reduced rates, to encourage the desired improvement.

The supply of pure water in some of the outlying districts is very deficient, and the Health Officer has commented on the suffering from guinea-worm experienced in the neighbourhood of Matunga. The question of providing a better supply is engaging my attention. It comprises the consideration of supplying water to Bandora and Kurla, which are beyond our limits, and the objection to tap the main before it reaches the storage reservoir. The subject will shortly be discussed in a separate report. Water supply.

Dr. Weir has written strongly on the ill-drained condition of various parts of the city, especially the Fort, Nagpada, Khara Talao, Phanaswadi, Kamathipura, and Dhobi Talao, the latter with regard more particularly to house connections which have been allowed to get into disrepair. I agree with all that he has said, and Agripada and Parel might with equal justice be added to the list. But a great step in advance has been taken by the Corporation in providing grants for improvements in public works. Phanaswadi Drainage.

will come within the new sewered district. The sewerage of Kamathipura is now nearly completed. As soon as the new pumping station is ready for work, experimental house fittings will be connected with the new sewer, and as far as the sanctioned works are concerned it now rests with the Executive Engineer to push them on with rapidity and efficiency, in order that the result may be satisfactory, and that these works may be succeeded by others. Meanwhile there is an urgent necessity for a complete survey, in order that any local work done may fit in with the general design, and because the well-grounded complaints of the present state of the Fort and other districts named make it impossible that the remedy should be long delayed. The first and most important requirement is to provide good sewers where now there are stagnant cesspools, and to join these new sewers with the new main artery completed last year. On the subject of house connections I have only to say that the Corporation have wisely determined to place their construction and control entirely in the hands of the municipality, whatever determination may hereafter be arrived at regarding payment of the cost. The necessary legal provision will be made in the amended Municipal Act, which is now under the consideration of Government.

Perhaps the most important event of the year in connexion with drainage was that in December the Corporation sanctioned the application for a further loan in order that an intercepting sewer may be constructed along the Queen's Road to join the new main sewer in Khetwady, with a view to prevent the discharge of sewage into Back Bay. The loan also provided for house connexions in the first drainage section and in Kamithipura, and for surveys for pipe sewers and house connexions in the Queen's Road district which constitutes the second section of the new drainage scheme.

Public health.

The census of 1881 gave a population of 773,196, more by 128,791 than that enumerated in 1872. Taking local divisions we find that the largest increase is in Kamathipura. Taking class divisions we find that the low-caste Hindus give the highest percentage of increase. The importance of these facts in connexion with the death returns is self-evident. The fact that the proportional excess of males over females in the total population is considerably less than in 1872 may be accepted as evidence of the greater accuracy of the recent census.

The number of births registered during the year was 17,840 (16,638 living and 1,202 still-born). The number of deaths exclusive of still-born children was 21,856. In the previous year there were 18,500 births (17,247 living and 1,253 still-born) and 21,146 deaths. The increase in the number of deaths is described by the Health Officer as being "chiefly due to diseases of the respiratory system and to cholera." There is a marked diminution in the number of deaths attributed to small-pox, measles, fever, and phthisis. Comparing the number of deaths in several sections of the community for this and last year I find the following :—

	Number registered in 1880.	Number registered in 1881.
Hindus	12,374	13,074
Hindu Outcastes	1,554	1,694
Mussulmans	5,154	4,907
Parsis	888	977
Europeans	195	238

The greatest number of deaths occurred in the Kamathipura sub-division, and the highest death-rate having regard to population was in Upper Colaba and in the Khara Talao (Nal Bazar) sub-division. Comparing the death-rate in the several castes or nationalities, we find the largest (leaving out of account Chinese and Negro Africans, whose numbers are so fluctuating that a correct percentage is unattainable) percentage among the Buddhists and Jains, a section which I imagine consists chiefly of Shravak Banias, and as they are a well-to-do class, the fact appears somewhat remarkable.

Vaccination.

The number of primary vaccinations was 18,591, as compared with 12,893 in the preceding year. It will be observed that the number of vaccinations exceeded the number of births by 1,953. It may be said that many of the vaccinations represent births of the preceding year, and this of course must be the case, but on the other hand many of the births recorded in the second half of the year will not be represented by vaccinations until the following year, so that this consideration will not ordinarily explain any great difference between the birth and vaccination figures. But there is no doubt that in the year under report the Act has been more strictly enforced, and the fact that the increase is especially marked in the earlier months of the year would warrant the inference that on this particular occasion an abnormally large number of the vaccinations

was on account of births of the preceding year. At the same time it is noteworthy that while the number of births and primary vaccinations among the Jewish community exactly corresponds, being 108 in each case, and that amongst the Parsis the difference is only 5 (births 1,325, vaccinations 1,320), we find amongst persons registered as Native Christians 1,005 vaccinations to 575 births, amongst Indo-Europeans 4 vaccinations to 85 births, and amongst Europeans 222 vaccinations to 178 births.

Registration.

In connexion with the subject of registration I observe that the birth-rate amongst Indo-Europeans is shown as high as nearly 73 per 1,000. This and other apparent anomalies which are noticeable on a scrutiny of the statistical tables show that our registration system is still far short of perfection in details, if not in total results, and as long as this is the case no theory based on the statistics can be advanced or accepted with any complete sense of conviction. The Health Officer has alluded to improvements which we are endeavouring to introduce in the registration of deaths, especially with reference to a more correct assignment of death causes. We hope to secure a certificate in every case in which the person dying has received medical treatment, and in other cases to obtain more accurate information than at present, by employing a better class of men, men with some medical training, as Assistant Registrars at the burial and burning grounds. But even this measure is attended with difficulty, on account of the great number of places used for the disposal of the dead, and the hardship and inconvenience which might be entailed if many of them were closed. No amendment of the law with regard to the registration of births has been proposed, and hitherto the punitive provisions of the section relating to this subject have remained a dead letter. I think that on occasions they might be enforced with advantage, though only exceptionally and under strict supervision, but I should attach much more importance to any scheme which would increase the value of a certificate of birth. If, for instance, it were the practice to demand the production of a certificate from candidates for the public service, or to accept a certificate as conclusive evidence of the age of children employed in factories, the possession of these documents would soon acquire a value in the eyes of the people themselves, and a direct incentive would be given to a more accurate registration of births.

ABSTRACT OF REPORT OF THE HEALTH OFFICER OF BOMBAY FOR 1881.

(*Surgeon-Major T. S. Weir.*)

Progress in sanitary work.

This year has been one of distinct progress—progress in continuous execution of sanitary works, and progress in strength and grasp of sanitary control—and advance towards the accomplishment and realisation of projects of vital and supreme importance to the public health.

It is to be regretted that the street drains already constructed in the first portion of a general drainage scheme are unusable and profitless yet, owing to connexions of buildings with the drains not having yet been made, although it must be stated that for the first time corporately the principle of house connexions or conduits between buildings and sewers or pipe drains for carriage of fœcal matter, has been acknowledged and sanctioned —experimentally, it is true, but still sanctioned and experimentally approved of; but it is also to be noted in connexion with this inexecution and non-completion of the first portion of the drainage scheme, 1stly, that in this year a further sum of Rs. 9,47,322 has been voted for the execution of further drainage works and operations embracing house connexions for sullage—provisionally and in the interval of experiments on privy construction; and secondly, of interest in connexion with the statement made in last annual report, namely, that the survey of buildings in the Kamathipura section had been completed, that Rs. 65,892 have been sanctioned for the completion and final execution of the drainage of Kamathipura—not the Kamathipura section of 64,658 population (which I regret), but the Kamathipura Proper portion of the section, of 28,455 people, a district, as previously described in some detail in annual report of 1879, the subject of an imperfect and abortive drainage experiment; and I may here make a mortuary statement of prospective interest, which is this, that the mortality in Kamathipura section is 206 less than in 1880; in 1881, 2,339 deaths are registered to 2,545 registered in 1880,—and I would now make mention of an important experiment in sewer ventilation (by shafts) which is to be primarily made in Kamathipura. It is to be regretted that house connexions have not been constructed, that the first portion of the drainage scheme has not been completed, and that therefore the advantages which are anticipated from a system of underground drainage on a European scientific model will not be reaped for some time.

The continuous execution of drainage sanitary works—progression in operations and measures for the improvement or amelioration of the public health or for the public convenience—has now become inevitable and cannot be avoided. The rapid growth of this great city has involved the responsibility of progression in measures for the protection and improvement of the public health; drainage operations must proceed synchronously with the expansion and extension of the city; the principle of drainage has been accepted, and the application of the principle will henceforth depend on the resources and opportunities of organisation, and the conquest of practical difficulties, and the adaptation of appliances to the instincts and habits of the people.

The sole responsibility arising out of the growth of the city is not confined to providing channels for the removal of the liquid refuse; when the drainage network has been completed the vital question of increasing the water-supply must be considered and discussed and decided also; for there is no doubt that the water-supply, with all appliances and measures recently adopted for improved and methodic distribution, is insufficient for the wants of the population at this time, and is still more insufficient prospectively. The population has increased 19·98 per cent. since 1872, and with the greater and increasing facilities for land and sea communication, while it is impossible to fix a limit for the future increase, it is not proceeding beyond the limits of rational speculation to conjecture, on the sound basis of the past nine years' experience, that the future expansion and growth of the city will not be less than in the past nine years; with improved and freer communication by land and sea, this city is in a different position to what it was with less freer communication in former years, and this altered position of the city must be distinctly recognised in shaping sanitary measures.

The expansion of the city has involved further responsibilities beyond the execution of sanitary engineering drainage works; with the execution of these works precaution and responsibility will not have ceased, and vital as these works are, they are indeed but a portion (a very important portion unquestionably) of other further measures that must be designed and carried out or enforced, and if these other and allied measures are not taken, then I must conscientiously say that in my expectation the extreme good possible and anticipated will not be realised; *great good will result*, life and health saving, but still the benefit and effect not to the extent possible or perhaps anticipated. I shall hereafter have to refer to the responsibility of preserving, in an effective and workable state, drainage works, more especially house connexions and conduits, after construction.

Medical relief.

A further responsibility in regard to the insufficient provision of medical relief for the poor of this city has latterly become more apparent; of the total number of people who die in this city, but a relatively small number have received in their last illness any medical treatment or counsel, and moreover in serious illness the proportion of the necessitous population treated by skilled and qualified medical men is small, and in fact among the poorer classes, at that evil period when heavy sickness falls on them, when stricken down with illness and unable to go to dispensary or practitioners, the proportion who receive any medical advice—and by medical advice and treatment I do not confine advice and treatment to a qualification boundary, but I apply it to any form of trained and organised intelligent medical relief beyond mere incantation and spell—is but small.

The responsibility has become so manifest in regard to providing hospital refuge (beyond already existing hospital relief) in central positions for persons suffering from zymotic diseases, more especially cholera, that in this year I have suggested that five open hospital buildings should be erected in central positions, and kept ready for receiving persons stricken with zymotic diseases, or for those other sufferers who, removed from buildings by our orders, are homeless and can find no home. Estimates are being prepared of the cost of the erection of these buildings; they will not cost much, as they will be of light structure, and the more open they will be the better; simply open buildings are required; when there are patients to be admitted, partitions of a combustible and cheap nature can be put in, and when the period of emergency has passed away these partitions can be destroyed. No permanent establishment need be employed. The formation of hospital refuges has frequently been recommended before, but at this period the suggestion is more directly due to Dr. Pinkerton. But even the formation of refuge hospitals, such as I have suggested, will not lessen or alleviate the want (which, I think, is chiefly felt and chiefly to be relieved) of medical relief being brought to the poor, and being available at the homes of the poor legally demandable as a right. I refer rather to a system of poor law medical relief than dispensary medicine administration. In the time of sickness and prostration from sickness among the poor,—and these occasions must be very numerous,—when unable to go forth to seek for medicine, home medical attendance is necessary; there should be an official agency through which, as a right, the poor could have a medical man to see them, medical treatment brought to them at their homes, and I myself think it is rather a reproach that there is no system of medical relief for the poor of this city at their homes, and that there is no organisation through which the poor can secure, as a right, at their homes, medical attendance in cases of urgency and distress. I do not overlook, in making this statement, the free open hospital relief, but yet it cannot be concealed that residence in hospital is not in harmony with the instincts and sympathies of the people—that they, the people—the masses, like not to enter the hospital. If a system of home medical attendance, on the order and responsibility of members of the corporation say, in conjunction with the existing outdoor hospital and dispensary relief, was organised, a vast amount of suffering would undoubtedly be saved, and possibly a vast amount of life. I need not further refer to this important question of home medical relief, for the necessity of it will be generally at once admitted, and it has become more important and pressing latterly, owing to the increase of the labouring immigration: for instance by the census of 1872, the Mahrathee population was 86,589, and by the census of 1881 there are 120,184, an increase of 38·8 per cent. of these industrial and disease-susceptible (owing to condition of living and life-struggle) elements.

Census of 1881.

The population enumerated in 1881 was 773,196 to 644,405 by the census of 1872, an increase of 19·98 per cent. over 1872.

On examining the tables before me of the sex distribution by the census of 1881, I observe that there has been a considerable decrease when contrasted with the census of 1872 in the preponderance of males over females; the proportion of males to each 100 females by the census of 1881 is 150·68 to 163·35 by the census of 1872; of each

100 of the population 60·11 are males against 62·03 in 1872, and 39·89 per cent. are females to 37·97 by the census of 1872.

The enormous increase in the Hindu low-caste population is of portentous import, and has the effect of exercising a powerful influence over the mortality; whatever sanitary improvements may be effected, the mortality of this city, with a population of 49,122 low-caste, assuming that their material and moral condition does not change, can never be so low as when the low-caste population was 31,347; 56·70 per cent. increase in the least healthiest elements is a terrible fact, and demonstrates how completely the sanitary position of the city has changed since 1872.

In every section except one there has been an increase of population, in some sections of extraordinary dimensions, and the expansion of population in the sections without the city proper is remarkable—a clear demonstration of the growth of the city within the last nine years.

Drainage.

I am glad to be able to state that the necessity of repairing the house connexions in Dhobi Talao has this year received attention. I have for some time been pointing out the deterioration and disorganisation of the house connexions made in 1872 in Dhobi Talao, and to urge that they should be restored and regularly repaired. I believe they have not been repaired at any time since their construction; they are corroding and breaking, portable portions being abstracted, and unless they are restored or repaired they will not only not perform the office they were intended to perform, but there will be no system of house connexions left in Dhobi Talao; and this section of the city, unless provided on another system, will be in a worse position than other portions of the city, for there will be a street exit of sewage. Refuse waters are seen lying on the sides of many of the streets, constituting a nuisance of some proportions; and, further, some houses built in recent years have not been connected on the system of house connexions of the district, and their sewage has a street side outfall and disposal not being able to flow into catch-pit reservoir, into which house connexions discharge; and, further, liquid refuse and water thrown on house gullies, not having passage to catch-pits, flows on to street sides through orifices in inter-house passage street boundary wall. The condition at this moment of the house connexions in Dhobi Talao is not satisfactory; the moral to be derived from their condition is clear, that the duty of the municipality in house drainage does not cease with construction of house connexions, when house connexions are made, an equal important duty, of constant supervision and repair, remains. It appears to me that the responsibility of keeping in a condition of effective repair, of maintaining the establishment required for constant inspection and repair of house connexions (for unquestionably an establishment will be required for this purpose if the works are to be kept workable, for there is not only actual wear of work, but injury and abstraction to be guarded against), has not yet been clearly realised, but it is a most serious responsibility and duty, and I would now earnestly raise my voice—not in alarm, but in warning—that unless an effective establishment is employed for the care of the drainage works, including especially house connexions, now being executed, not only will these works fail ultimately to some degree in their purpose, but from the public money spent on them the fullest possible benefit to the public health that may be derived will not certainly be derivable.

I have had in this year to ask a further consideration of the system of sewer ventilation, and to recommend that the ventilation of a number (a list of which I prepared) of sewers and drains should be improved. The expense of ventilating the smaller drains, although the necessity of improving the ventilation of these conduits is unquestionable, being heavy, and in the opinion of the Engineer greater than the probable good, the drains being so imperfect that they should be replaced by new ones, has caused the measure to be abandoned, but still I am glad to say that 56 manholes have been constructed in drains in 1881; the fact of this construction being necessary in 1881 is a cogent demonstration of the imperfect and dangerous condition of existing underground drains, and of the necessity for their reconstruction, and a proof of the exigency of improvement.

The drainage of the Fort (generally as a section) is very defective; the effluvia from the drainage of the southern portion of the Fort attracts most attention, as the roads are largely frequented and crowded thoroughfares, and possibly the emanations are more noxious owing to the drains in the southern portion having relatively fewer openings for foul gasses to escape from. I do not, however, think, notwithstanding its conspicuous offensiveness and disgustingness, that the drainage of the southern portion of the Fort is in a more defective condition and state than the drainage of the northern Fort section; the southern portion of the Fort has the advantage of some drains modern in construction, although these drains are imperfect in serving the purpose for which they were constructed, inasmuch as they have been built of proportions to carry rain water, and, further, they

are not a portion of tributary of the island drainage circulation. The drainage of the northern portion of the Fort is defective in every respect except one, viz., multiplicity of openings for escape of foul air or the admission of fresh air; in some streets there are openings at intervals of every 11 or 12 feet, and hence it is, I believe, that the old imperfect drains are less conspicuously offensive than modern-constructed drains.

The published death-rate does not faithfully represent the mortality in the Fort; it is reduced through the existence of elements and classes of prosperous vitality and other factors.

The attention devoted to the improvement of buildings in the previous year has continued. In new buildings I have demanded open spaces, of proportionate sizes, for ventilation; great good is being effected, which will be more apparent and evident hereafter; the lighting of buildings, the free admission of air, the freer access of light, have revealed dangerous forms of connexion between buildings (and, further, most dangerous, the bathing-niche in the corner of sleeping-rooms), and old covered drains; the full light and air making perceptible sewer emanations not perceptible before. I have had to bring to notice a good many instances of pollution of buildings by sewer air, and in some instances the sewer odours perceptible in buildings through direct and hidden connexion created a disgusting nuisance. But direct connexion of building and room with covered drain is not confined to the buildings of the poor; there are many fine buildings in the Fort (some of which Mr. Walton and I have inspected), which have house connexions constructed in defiance not only of the ordinary rational principles on which house connexions should be made, but in defiance of the instincts of common sense. What I have observed in this city leads me to think that the difficulty, when the first portion of the new drainage system has been executed, will not be to induce the people to make connexions with the drains, but the difficulty will be to prevent dangerous direct connexions being secretly made. An active danger to be guarded against is the ingenious and confident plumber.

Disease—detection.

A proposal for some time contemplated will be adopted this year—the co-operation of medical men and of the more reliable unqualified practitioners in detecting epidemic diseases will be asked. I shall distribute papers showing the shape in which information is to be forwarded to me; an important alteration in the Municipal Acts will if it becomes law constrain the reporting by medical men of epidemic types of disease which they may become cognizant of, and certain penalties for neglecting to afford information will be imposed.

Registration of deaths.

In this year there has been considerable discussion regarding the registration of deaths; I have written much on this question, and in this year I submitted a report exhibiting a scheme of registration; a portion of the scheme has been accepted, and the scheme has been considered in connexion with possible amendments in the municipal law, and possible concentration of places for disposal of the dead. The present system is not perfect, but it is not so imperfect in comparison with other systems in other countries as is sometimes conjectured. It is easily capable of improvement; it is simply a question of expense—whether it is the best possible expenditure of money having regard to other pressing needs; important alterations in the law have been proposed in the amendments to the Municipal Acts recommended, and if these amendments become law the scheme I have proposed will secure, in proportion to the completeness of its adoption, more perfect registration than at present; whatever system of registration may be adopted, exact information in regard to the causes of death is only possible with a wide system of medical relief.

Water-supply.

The Vehar water-supply did not present any abnormal features beyond the excessive quantity of vegetable matter usually observed. The Tulsi water became very impure before the annual monsoon dilution, and towards the end of the year a dangerous amount of vegetable impurities in the water was observed. The construction of filter beds is proceeding.

Improvement of cattle-stables.

The prosecution of cattle-stable owners, with the object of having buildings in suitable positions but unsuitable in construction improved in agreement with the bye-laws, or buildings in unsuitable positions disused, has actively proceeded, and has led to a very considerable abandonment and emptying of cattle-stables in the city, and further led to some 700 buffaloes and bullocks being removed from the crowded city to vacant ground on the foreshore.

Harbour sanitation.

The absence of any establishment for sanitary supervision of the Harbour has been receiving close attention. There is now, I hope, a near prospect of a Harbour sanitary staff being appointed.

Guinea worm at Gowaree.

The former notoriety of Matoonga for guinea-worm has been recalled to memory this year in the experience of one village, and happily only one village, by name Gowaree.

This village has been dreadfully afflicted by this scourge; the villages on either side have been unafflicted. Gowaree draws its supply of drinking water from a well of muddy surface water about a mile to the east of the village; the villages on either side are supplied with Vehar water. Gowaree has been smitten, the villages on either side have been exempt. The sanitary condition of Gowaree is the same (except in water-supply) as the villages on either side; the most probable source of infection is the well water used by Gowaree villagers. The villagers have begged for Vehar water. I inspected the village more than once; the condition of the people was pitiable; there are some 40 houses and some 297 inhabitants; of the 297 inhabitants 89 were suffering from guinea-worm, and of the 40 houses people were suffering in most of the houses—a most distressing spectacle: one young woman with a child had 16 manifestations of filaria. In the village, out of 297 people (so far as I could ascertain), one had never suffered from guinea-worm. The people were poor, their sufferings increased the difficulties of life. The experience of this village recalls to mind descriptions of the condition of life from a sanitary view in years gone past in Matoonga.

Vital statistics.

Exclusive of still-born, 21,856 deaths were registered, a mortality 3,137 less than the mean of the previous five years, although it must be stated that the total number of deaths is greater than in 1880, the previous year, by 710 deaths, the enhancement being chiefly due to diseases of the respiratory system and cholera, diarrhœal fatality, as would be anticipated, being in excess of the previous year; nevertheless the fever mortality is 1,076 less than in 1880, 2,483 less than the quinquennial mean; and moreover it must be stated, being a circumstance of an assuring and hopeful character, that the infant mortality under five years is 417 less than in the previous year, 1880. The death-rate, estimating for increase of population, is equal to 27·65 per 1,000 to a death-rate of 27·34 in 1880. Whilst the total death-rate of the city is 27·65, the death-rate amongst a large permanent and unfluctuating class of the population—the Parsee—is but 20·10, the incidence of the race mortality amongst the chief divisions of people fluctuates between 20·10 and 55·87; at one extremity is the Parsee population with a death-rate of 20·10, at the other extremity are Hindu low-castes, a large and increasing class, with a death-rate of 34·48.

The mortality according to race is very instructive. The variation in the incidence of the race mortality is not only a question of surrounding sanitary or insanitary conditions, potent factors as they are, but it is also a question of degrees of sustenance and mode of living and inner life. It appears to me that on observation of the divergent conditions under which large and distinct classes live, the true cause interpretation of the widely varying severity of the race mortality will be found.

Arranged according to death causes, the proportional mortality, calculated on the actual population of 1881, is shown in the following table; the decline in the mortality from fevers 3·34, and in phthisis 1·31 (although its import is affected by an increase of mortality from diseases of the respiratory system 1·85) will be observed.

Causes of Death.	Number of Deaths.	Ratio per 1,000 of Population.	
Small-pox - - - -	35	0·05	
Measles - - - -	192	0·25	
Fever - - - -	6,437	8·32	
Cholera - - - -	546	0·71	
Phthisis - - - -	2,232	2·89	
Diseases of Nervous System -	2,258	2·92	* Annual increment of population is calculated.
Do. Respiratory do. -	3,799	4·91	
Diarrhœa - - - -	1,341	1·73	
Dysentery - - - -	721	0·93	
Accidents - - - -	371	0·48	
All other causes except still-born -	3,924	5·07	
Total - - -	21,856	27·65*	

Small-pox.

Only 35 deaths were registered from small-pox, being 172 less than the last year, and 1,000 less than the quinquennial mean; the trifling mortality in this year must not be permitted to create a feeling of over-confidence and trust.

Fevers.

There has been a large reduction in the mortality from fevers; 6,437 deaths from fevers were registered, which is a mortality 1,076 less than the mortality in 1880, and 2,483 less than the average of the previous 5 years; 5,084 deaths were referred to remittent fever, being 1,780 less than the mortality in 1880, and 3,243 less than the

quinquennial mean. This is a very remarkable reduction in the mortality from remittent fever; in the previous year there had also been a fall of 989 deaths in the mortality from remittent fever. To simple continued fever 400 deaths were referred, to ague 942 deaths, and to enteric fever 11 deaths; the mortality from enteric fever simply indicates that so many cases were identified by medical men as cases of enteric fever.

Cholera.

In the first quarter the mortality from cholera was exceptionally low (in the year 1880 only 30 deaths were registered), 2 deaths occurred; in the second quarter, however, synchronously with cholera revitalisation in Western India, the disease acquired intensity in this city. The mortality had been progressively diminishing from July through August, September, and October, till in November it descended to 9 deaths; from the 27th of October till the 14th of November there had been no deaths from cholera; on the 12th November 3 cases were observed, but the disease did not become prevalent till after the first week in December. It is remarkable that 2 out of the first 3 cases on the 12th November had recently returned from the pilgrimage to Pandharpur; the third case occurred in Mahim.

While in this year there has been no distinct concentration around particular sources of water-supply, there has been a distinct intensity of manifestation in particular districts and around particular centres of population; but the incidence of the proportional mortality from cholera and the total mortality from all causes has not fallen uniformly by sections; sections of the highest total mortality are not sections of highest cholera mortality; there are therefore apparently causes or conditions in particular sections favouring or predisposing to the growth of cholera; these causes have yet to be differentiated. The chief predisposing cause appeared to be of an individual personal nature, so to speak; undoubtedly an individual predisposition of constitution is a chief predisposing factor. The most uniform conditions I observed surrounding groups of cholera cases were, shortly, dampness,—dampness of ground,—of walls, imperfect ventilation and resulting air impurities; the exciting agencies of greatest potency, inasmuch as of most frequent occurrence, appeared to be dampness—humidity, which implies soil saturation and pollution arising from imperfect channels for removal of sewage—sewage stagnation and soil saturation and pollution being in the relation of cause and effect—air impurity and dankness arising from defective ventilation and lighting, dwelling and surface crowding.

In this year, as in every other period, cases of cholera, exceptional no doubt, occurred in good rooms in well-ventilated buildings, and in exceptional subjects. I was not able clearly to trace any cases to contaminated sources of water-supply.

The greatest mortality occurred in Phanaswadi, a section in which the disease appears to have been first revitalised or originated; the mortality is equal to 2·36 per 1,000; 55 deaths occurred, 52 of which took place in the second quarter. The conditions of unwholesomeness most evident in this section are foul drainage or no drainage, concentration of labouring and immigration elements, and house and room crowding. The drainage, in the sense of open channels for removal of sewage (for there is no system of underground drainage) of Phanaswadi is very imperfect—it could scarcely be more imperfect in a large city—and very bad, generally ill-constructed or unmade, irregular, and surface-leaking waterways and superficial cesspools; the greatest protection and safety to the public health from the imperfection of these channels being in their openness, in the facility with which their contents can be removed and their effluvia dissipated and destroyed. The district of second highest mortality is Girgaum, a district of equally imperfect drainage with Phanaswadi, of imperfect, ill-constructed or unmade open tracks for sewage channels or cesspools. The third highest mortality is in the Esplanade; in this section the severest fatality occurred in the third quarter, equal to 7·03 per 1,000; this severe mortality is due to Boree Bunder regimental lines and the municipal scavenger lines being in the Esplanade, and concentration of cholera incidence, occurring more especially in the regimental lines. The section of next greatest fatality is Mahim; in connexion with the mortality in Mahim and other sections undrained within and without the city, I would again draw attention to the absence of drainage in the outlying and moreover in many parts of the city itself. It is not a question (in many portions of the city) of which form of drainage is the best to be adopted: it is a question of any channels, however rude, to carry away the sewage from the dwellings of the people, so that the health of the population may not be tainted; in connexion with the mortality from cholera and other diseases in Mahim and other outlying portions of the island, I am glad to state that it is now in contemplation to extend the Municipal halalcore service to Mahim and the other outlying districts and over the island. Information is being prepared to

enable the organisation of an additional establishment of halalcores being effected, the expense attending this measure having hitherto prevented its adoption.

The precautions taken were of a stringent, and in some instances of a severe and radical nature. Very stringent measures were taken in the shape of preventive and precautionary action. Over 500 persons were removed from buildings in which the development of the disease assumed a virulent form, and therefore a presumption of local causes and agencies which justified this severe measure. The tiles were taken off the roofs of buildings in other cases of less severity, and holes made in the roofs and sides of buildings so as to let in light and air freely. The earthen floors were dug up and sprinkled with carbolic acid, walls washed with a solution of carbolic acid or lime. The ordinary disinfectants were freely used internally and externally in infected buildings and in infected oarts, or gardens, which were also thoroughly cleansed.

Marked improvement has been effected in buildings in which cholera appeared. In a double chawl in Phanaswadi, already specially referred to, vast improvement has been effected; in the covered passage openings were made, the eaves cut, and the plinth of rooms raised; the chawls are now light and cheerful, formerly they were dark and wretched. In other buildings vast improvements have been effected; the opportunity has been taken of forming air spaces in the buildings. A class of building which was specially affected was that class of chawl to which so much supervising attention is given, and must be given, not only in regard to construction originally, but in regard to subsequent expansion.

As regards the mortality by districts, the highest mortality has been actually registered in Upper Colaba; the high death-rate in Upper Colaba is due to the fact of 26 deaths having occurred amongst Europeans of the military class passing through or resting in Colaba; deducting the 26 deaths the mortality is 31·39. I wrote to Dr. Codrington, in charge of the Staff Hospital, Colaba, in regard to the high proportion mortality amongst Europeans; this is Dr. Codrington's reply, and it is to me very interesting, and also of much suggestive value:—"There were 48 deaths amongst the "military in Colaba during the year 1881, of these 22 occurred amongst those quartered "in the station, and 26 amongst persons passing through. In the latter class were the "seven deaths from measles. All persons who on the arrival of a troopship are too ill to "proceed to their station in India, and invalids on their way home who are too ill to "proceed to Deolali are detained here; hence during the trooping season there are "always many cases of illness of the severest character admitted from others than those "quartered here, and the mortality is very high. During the last two years *this has* "*been higher than usual owing to the arrival of invalids from Southern Afghanistan.*

The mortality of the population in Khara Talao is therefore in reality the highest, 40·04. In reference to the high rate of mortality in this section, I have recommended that the open space of ground in Goolam Mohideen Street, in this section, should be purchased for a public garden, a place of wholesome recreation and exercise.

In the third quarterly report I drew attention to the high rate of mortality in Khara Talao, and suggested one form of public health amelioration; the mortality in Khara Talao in 1881 is, as I have before stated, 40·04 per 1,000, the actual number of deaths being four more than in 1880. Khara Talao is a section solely of underground drainage (drains or water-ways underground), the drains are square, imperfectly designed, imperfectly constructed; through the imperfections of design or construction, and time and age results, and altered building positions, and street levels, or the imperfect, badly constructed, unsystematically or wrongly designed connections drains flow not now freely—their circulation is retarded or obstructed, or even regurgitation in some instances is observed.

The population of Khara Talao has increased 21·37 per cent. since 1872; by the census of the year 1872 there were 8·40 square yards to each person, and by the census of 1881 there are only 6·93 square yards to each person—only 6·93 square yards to each person; the superficial room for each person in the section has diminished, while house accommodation and crowding has increased from 767 to 1,491; but sanitary measures, constructive or administrative, have not increased proportionately to the increase of the population. The district was fearfully overcrowded in 1872, it is still more fearfully overcrowded in 1881; there are many buildings, occupied by the poorest classes, of the most unwholesome construction—so constructed that no vital improvement is possible except through demolitions; these buildings are fearfully overcrowded, they are often of this nature—consisting of two double rooms, on one side communicating with a public passage or road, from which extending backwards, generally with no lateral open breathing passages, they have a gully (sewage flowing) exposure; these rooms are double, those in front are ventilated from passage, those in

back gully air-breathing ventilation; there may be one family—exceptional—or there may be more than one—most general.

There are other types of buildings for the poor, but not, I think, so dangerously constructed and disposed; there are some buildings in Khara Talao, occupied by shoemakers and other outcastes, terribly crowded, fearful mingling of human beings, hideous pollutions. Improvements have been effected in many, yet in proportion to the total buildings, but few of the buildings in Khara Talao; in the new buildings constructed very great improvements have been made, but the improvement of the older long-lived buildings will be but gradual; improvement is taking place surely but gradually, and necessarily slowly; the section drainage requires to be reconstructed; these improvements are the more necessary inasmuch as there is a large wandering vagabond population, some in huts, most in buildings, and of the population 10·59 per cent. are outcasts. By the census of 1881 there were 340 homeless in this section.

A large number of persons living in Khara Talao are addicted to the excessive use of intoxicating drugs and associated vices; they become enfeebled apparently—lose energy and vitality. In 1872 the Health Officer thus referred to Khara Talao:—"I could conscientiously declare a great number of houses in this district as unfit for human habitation, but what is to become of the poor wretched tenants in the meantime?"

Further, there is in Khara Talao the great Moslem pilgrim resting-house; to this travellers' rest-house pilgrims, many of whom are in a feeble state of health, some suffering from disease, from all portions of Asia, come, and from here they go to the land of pilgrimage or return to their homes; around the rest-house pilgrims congregate, and in the streets pilgrims live; this pilgrim factor is no doubt a great element in swelling the Khara Talao mortality and also affecting the city mortality.

In the Kamathipura section 2,339 deaths were registered this year, being 206 less than the mortality in 1880; this reduction is a favourable sign; but the proportional mortality of Kamathipura proper is still high; the large, indeed fearful, proportion of low-castes in the population, 22·23 per cent., in Kamathipura proper must raise the death-rate relatively to a district in which there is a very much less proportion of low-castes. I hope the new system of drainage for Kamathipura will be completed in this year—1882.

Local diseases.

With cholera prevalence there is, as would be anticipated, an increased mortality over a year of cholera dormancy such as the last, from diseases of the digestive system, more especially diarrhœa, while dysenteric fatality is less; 2,566 deaths from diseases of the digestive system were registered, being 202 more than the mortality of the past year, and 891 less than the mean of the past 5 years; 1,341 were referred to diarrhœa, being 607 more than the mortality of the past year, and 232 more than the average of the past 5 years; to dysentery 721 were ascribed—273 less than the last year, and 795 less than the mean; to all other diseases of the digestive system 504 deaths—132 less than in 1880, and 328 less than the mean.

The mortality from diseases of the respiratory system is 1,826 more than in the last year, and 1,678 more than the mean of the past 5 years; 2,175 were ascribed to bronchitis, being 1,140 more than the last year, and 1,177 more than the mean of the past 5 years; to pneumonia 1,027 were referred—150 more than the last year, but 19 less than the average of the past 5 years. It is possible that the increased mortality from diseases of the respiratory system may be due in some degree to meteorological phenomena; the greater prevalence of land winds must have the effect of increasing the prevalence of respiratory diseases, and there is the fact of factory labour influences, in their present extent and force, of recent growth, and therefore not yet estimated.

Births.

During the year 16,638 living and 1,202 still-born births were registered, against 17,247 living and 1,253 still-born births in 1880; of the children born living 8,675 were males and 7,963 females; the proportion of male to female births is as 108·9 to 100 females, the proportion in 1880 being 119·45 to 100. The sex proportional mortality in 1881 is in the ratio of 112·97 to 100. The birth-rate is equal to 21·51 per 1,000 of population. The number of premature births is 279, being 80 more than in the last year, and 174 more than the mean.

APPENDIX.

No. 1.

MEMORANDUM of the ARMY SANITARY COMMISSION on the REPORT of the SANITARY COMMISSIONER with the GOVERNMENT of INDIA for 1881.

Dr. Cuningham's Report for 1881 contains so large an amount of detail bearing on the sanitary condition of troops, prisoners, and the vast civil population from which data have been supplied, that it would be no easy matter to give a full account of its contents, but we shall take from it the more important points and practical lessons which it appears to teach.

The Report is divided into the usual 10 sections, the first of which contains Mr. Blanford's summary of Indian climates for 1881. Sections II. and III. deal with the statistics and sanitary history of British and Native troops. Section IV. gives the jail statistics. In Sections V. and VI. are discussed the vital statistics and disease history of the civil population. Section VII. treats of the general history of vaccination. Sections VIII. and IX. give a general account of sanitary works at military stations and municipalities, and the concluding Section X. contains general remarks on the year's proceedings. The Report is followed by a memorandum, drawn up by Dr. T. R. Lewis, on a cholera outbreak at Aden, and by the annual vital statistics of the European and Native Armies and jail population drawn up by Dr. Stephen, who appears to be a worthy successor to the late lamented Dr. Bryden; and by the combined labours of these statistical officers, Dr. Cuningham has been enabled to give a more complete statistical history of the Indian army than it has been possible to furnish in previous years.

1. We shall discuss the facts in the usual order, beginning with the vital statistics and sanitary history of the European and Native armies.

European Troops.—The following are the chief statistical facts under this head for the whole Indian Army:—

Strength, including troops in Afghanistan	58,728
Admissions to hospital	94,236
Average daily sick	4,095
Deaths	990
Invalids	2,241

These numbers reduced to ratios per 1,000, and including the Afghanistan troops, give the following results:—

	Per 1,000.
Admissions	1,604
Daily sick	69
Deaths	16·86
Invaliding	38
Total loss	55

The next abstract gives the ratios for each Presidency, but excluding the Afghanistan troops unless otherwise stated.

Armies.	Strength.	Ratio per 1,000 Strength.				
		Admission to Hospital.	Daily Sick.	Deaths.	Invaliding.	Total Loss.
Bengal	35,901	1,729	72	17·05	37*	54*
Madras	10,891	1,160	60	10·97	28	39
Bombay	9,895	1,764	72	13·44	33*	47*

* Including troops in Afghanistan.

2. It may be remembered that the Royal Commission on the sanitary state of the Indian army gave as a conclusion arrived at from the statistical records then available, that in past years, the death-rate among European troops in India had circulated round 69 per 1,000 per annum, sometimes under, at other times exceeding this ratio. Subsequently to the issue of their report in 1863 great and continuous improvements were carried out at many stations, and the death-rates fell in a very marked degree until, in 1877, the rate in India was no higher than 12·71 per 1,000, the lowest on record. About this time, short service and young ages began to raise the death-rate, and then came

the years of the Afghan war, which coincided with years of scarcity of food all over India, and at the same time men who had suffered in the field returned to the cantonments in India, there to raise the death and inefficiency rates. The influence of field service on the general health of the Army has nearly passed away, and the rates are again falling, as may be seen from the following data, which include the whole Indian army except troops stationed in Afghanistan in 1879–80:—

Years.	Average Strength.	Ratio per 1,000 Strength.				
		Admissions.	Daily Sick.	Deaths.	Invaliding.	Total Loss.
1877	57,260	1,257	56	12·71	42	55
1878	56,475	1,651	67	21·46	45	66
1879	49,582	1,977	78	24·28	49*	73*
1880	51,796	2,789	74	24·85	26*	51*
1881*	58,728	1,604	69	16·86	38	55

* Including troops in Afghanistan.

Troops in Afghanistan during 1881, consisted partly of contingents from Bengal, partly from Bombay. The strength in January was 3,837, and in December it was only 860. The average number was 2,541, and the inefficiency ratios per 1,000 were as follows:—

Daily sick	71·6
Deaths	51·55
Admissions	968·10

3. We are now in a position to compare the 10 years' rates ending 1879 with those of 1880 and 1881 for the whole Indian European Army as follows:—

Periods.	Strength.	Ratio per 1,000 Strength.				
		Admissions.	Daily Sick.	Deaths.	Invaliding.	Total Loss.
1870–79	577,416	1,475	60	19·34	43	62
1880*	51,796	1,789	74	24·85	26†	51†
1881†	58,728	1,604	69	16·86	38	55

* Excluding troops in Afghanistan. † Including troops in Afghanistan.

During the 10 years 1870 to 1879, the death-rate circulated round, not 69 per 1,000, but 19·34 per 1,000. The impress of the Afghan war is seen still in 1880, but in 1881 the death-rate shows a great reduction.

4. As nearly two thirds of the army are stationed in Bengal, a better idea of the facts will be obtained from the following abstract of its sanitary history for 22 years past:—

Bengal European Army.

Periods.	Annual Ratio per 1,000.				
	Admissions.	Daily Sick.	Deaths.	Invaliding.	Total Loss.
1860–69	1,755	67	29·98	41	71
1870–79	1,522	61	21·00	41	62
1880*	1,813	75	27·73	22†	50†
1881*	1,729	72	17·05	37†	54†

* Excluding troops in Afghanistan. † Including troops in Afghanistan.

5. It is not necessary to repeat these comparative statistics for all three Presidencies, but the death-rates may be here introduced for all three to complete the history.

Armies.	Periods.	Deaths per 1,000 Strength.
Bengal	1860–69	29·98
	1870–79	21·00
	1880*	27·73
	1881*	17·05
Madras	1860–69	19·99
	1870–79	17·69
	1880	10·18
	1881	10·97
Bombay	1860–64	22·61
	1865–69	20·48
	1870–79	15·27
	1880	30·90
	1881*	13·44

* Excluding troops in Afghanistan.

The data point to a steady reduction in the death-rates of European troops in each Presidency, but in Bengal and Bombay the temporary influence of the Afghan war is strikingly manifest in the great rise of mortality, now happily passing away with the war years.

6. We shall next give a brief analysis of the chief diseases and death causes, beginning with the statistical data for 1881, for the whole Indian European army.

Diseases.	Deaths.	Ratios per 1,000 Strength.	
		Admissions.	Deaths.
Cholera	127	3·4	2·33
Small-pox	1	†3	0·02
Enteric fever	155	5·6	2·64
Intermittent fever	4	581·5	0·01
Remittent fever	33	87·2	0·65
Continued fever	5		
Apoplexy	87	3·9	1·48
Delirium tremens	10	3·9	0·17
Dysentery	101	32·1	1·72
Diarrhœa	19	56·5	0·32
Hepatitis	94	31·9	1·60
Spleen diseases	2	5·7	0·03
Respiratory diseases	103	88·4	1·76
Heart diseases	32	—	0·54
Phthisis pulmonalis	44	7·1	0·75
Dropsy	1	—	0·02
Scurvy	—	·5	—
Anæmia and debility	5	—	0·09
Rheumatism	—	4·7	
Venereal diseases	—	260·5	
Abscess and ulcer	—	102·2	0·31
Wounds and accidents	7	—	
All other causes	84	198·2	
Suicide	84	—	0·58
Died out of hospital	32	—	0·54

In this enumeration the chief Indian epidemic to which in times past the most attention has been given, namely, cholera, occupies, as will be seen, a secondary position. The principal death cause of the year was enteric fever, a disease which is only one of the febrile group, and to show anew the importance of Indian fevers to Army efficiency it may be useful to give the actual admissions and deaths from each of these causes.

Diseases.	Admissions, 1881.	Deaths, 1881.
Cholera	199	127
Enteric fever	328	155
Remittent fever	921	33
Intermittent fever	34,149	4
Continued fever	4,198	5

The practical teaching of this table is that the efficiency of the army has a much more intimate relation to climatic, local, and personal causes of fevers than it has to epidemic cholera, and it follows that every effort should be made to eradicate fever causes, and if this view be acted on there will be less heard of cholera.

7. We have already stated the death and inefficiency causes for the three Presidencies, and we shall next analyse the Bengal data in order to localize the rates and to see where improvements are required. The following are the results for 1881 :—

Stations in	Average Strength.	Ratios per 1,000.	
		Admissions.	Deaths.
Bengal Proper	1,913	1,610	12·02
Gangetic Provinces and Oudh	7,401	1,741	15·94
Meerut and Rohilcund	3,819	1,867	17·81
Agra and Central India	4,252	1,728	10·11
Punjab	11,433	1,949	23·44
Hill Stations	4,816	1,177	9·97
Presidencies:—			
Bengal	35,901*	1,729*	17·05*
Madras	10,891	1,160	10·97
Bombay	9,895†	1,784†	13·44†

* Including depôts. † Exclusive of troops in Afghanistan.

In a previous table we have given the army mortality as a whole for groups of years showing the great reduction in death-rates during the periods, and we shall next see in what diseases the mortality has fallen.

Dr. Bryden, in his "Statistical History" for 1876 (page 50), has given the admissions from cholera in regiments in their first year between the years 1864 and 1869 in Bengal as 18·7 per 1,000. The admissions during the 10 years period in the Bengal Army (1870–79) averaged 5·9 per 1·000. The admission-rate was the same in 1880, and in 1881 it was 3·4 per 1,000. There was thus a large reduction in the amount of cholera received for treatment, and the following abstract gives the death-rates for groups of years in each Presidency army.

Periods.	Cholera Deaths per 1,000.		
	Bengal.	Madras.	Bombay.
1860–69	9·24	—	—
1870–79	4·18	1·68	1·53
1880	4·84*	0·10	—
1881	3·23*	1·79	0·30*

* Excluding troops in Afghanistan and on the march.

This abstract shows how much less liable troops are to cholera in Madras and Bombay than they are in Bengal. That indeed Bengal Presidency has been the chief seat of cholera during the entire period, and that although a great reduction in the death-rate has taken place in Bengal, it is still about double the past rate in the south of India. One element in reduction of death-rates has however, been the falling off in deaths from cholera in Bengal to about one-half of their former amount, and to nearly one-third in 1881.

8. The next abstract gives the corresponding data for fevers:—

Years.	Death Ratios per 1,000 Strength.					
	Bengal.		Madras.		Bombay.	
	Enteric Fever.	Remittent and Continued.	Enteric Fever.	Remittent and Continued.	Enteric Fever.	Remittent and Continued.
1860–69	—	2·92	—	—	—	—
1870–79	2·28	1·74	1·42	0·62	1·75	1·14
1880	2·07	2·34	1·36	0·29	5·76	2·73
1881	2·62	0·70	0·58	0·19	2·83	0·91

The enteric fever death-rate in Bombay is greatly due to two or three stations. In the other Presidencies the fever-rates have fallen, but the figures show that much yet requires to be done at the stations.

We have separated these two disease groups as being more or less connected with local causes, but there are other diseases which have shown a marked reduction in death-rates of recent years. We have arranged these as follows:—

Periods.	Death-rates per 1,000.								
	Bengal.			Madras.			Bombay.		
	Apoplexy.	Hepatitis.	Dysentery.	Apoplexy.	Hepatitis.	Dysentery.	Apoplexy.	Hepatitis.	Dysentery.
1860–69	2·12	3·31	2·72	—	—	—	—	—	—
1870–79	1·53	2·04	1·37	1·42	3·16	2·32	1·56	1·71	0·98
1880	3·14	1·36	2·72	0·78	1·26	0·58	3·03	1·31	4·14
1881	1·75	1·66	1·00	0·96	1·34	1·15	1·21	1·52	4·82

These diseases, besides being connected with climatic causes, are largely influenced by the personal habits of troops, and taking the whole group of facts as they stand, and including the entire death-rates of the periods, there seems to be evidence to justify an opinion that the general management of troops, their better habits, and improvements at stations have all assisted in better health of late years.

9. These figures show the general results for the Presidencies, and the following abstract gives the reductions which have taken place in groups of stations in Bengal Presidency in 1881 when compared with the rates in the decade 1860 to 1869:—

BENGAL PROPER.

Districts.	Ratios per 1,000 Strength.			
	1860 to 1869.		1881.	
	Admissions.	Deaths.	Admissions.	Deaths.
Bengal Proper	1,821	29·57	1,610	12·02
Gangetic Provinces and Oudh	1,615	28·59	1,741	15·94
Meerut and Rohilcund	1,576	26·61	1,867	17·81
Agra and Central India	2,169	38·48	1,728	10·11
Punjab	1,741	25·24	1,949	23·44
Hill Stations	1,069	14·78	1,177	9·22
Bengal Presidency	1,755	29·98	1,729	17·07

It should be stated that the columns of admissions cannot be properly used for comparison between the years because of the large proportion of venereal cases which the admissions include. In the Bengal stations the venereal admissions numbered no fewer than 276 per 1,000 in 1881. The great admission cause at all the stations was malarial fever, and of the admission ratios for Bengal Presidency these fevers accounted in 1881 for 764 per 1,000 strength. The death ratios afford a better means of comparison, and these have all fallen in a notable degree except in the case of the Punjab, which in every way is now the most unhealthy region in India for British troops. Reduced death-rates have taken place at nearly all the 49 stations, including hill stations, in Bengal Presidency. The following are the exceptions. The data are for two decades:—

Stations.	Deaths per 1,000.	
	1860–69.	1870–79.
Fyzabad	20·1	24·9
Jullundur	15·19	19·2
Ferozepore	14·0	17·3
Dera Ismail Khan	11·8	17·1
Sialkote	11·2	17·9
Rawal Pindee	13·3	15·6
Attock	17·6	24·1
Nowshera	15·8	17·2

It ought, however, to be stated that the Fyzabad rate in 1880 was 11·20 per 1,000, and 6·12 per 1,000 in 1881.

It is obvious from these figures that at these Oudh and Punjab stations there has been a rise in the death-rates during the second decade, which calls for inquiry. There must be reasons for it.

The rise is not very great, but it is there, and may increase unless looked after.

On the other hand, there have been remarkable reductions of death-rates at other stations in the same districts.

At Meean Meer, for example, the death-rate during the first decade was not less than 70·4 per 1,000, and during the second 34·8 per 1,000. Peshawur, which during the first decade had a death-rate of 41·6, had a rate in the second decade of 28·5, but this 20 years' history has been broken in upon by the death-rate of 1881, which reached the great ratio of 84·08 per 1,000, of which 52·37 per 1,000 was due to cholera. The death-rate at Fort Lahore was 57·1 during the first decade, and 38 during the second. Allahabad, in the North-West Provinces, had a death-rate in the first decade of 48·6, and during the second of 20·9 per 1,000.

But the most remarkable examples of reduced death-rates are those afforded by stations in Bengal proper. Of these Fort William was in former times the most unhealthy spot in India, or perhaps anywhere else, for European troops. Its death-rate for 10 years preceding 1856 is given in the tables appended to the Report of the Royal Commission on the sanitary state of the Indian army at 102·35 per 1,000. Since that time great improvements in barracks, drainage, water-supply, &c., have been carried out, and in the decade 1860 to 1869, the death-rate was 25·19 per 1,000. In the following decade, 1870 to 1879, the deaths had fallen to 10·78 per 1,000, in 1880 the rate was 11·55, or ·77 per 1,000 higher, and in 1881 it was 4·32 per 1,000, a single year's exceptional rate no doubt.

Dum Dum had a death-rate during the first decade of 32·70 per 1,000, during the second of 15·33 per 1,000, and in 1881 the rate was 17·7 per 1,000. At Fort William the cholera death-rate averaged 8·85 per 1,000 in the decade 1860—69. It was 1·26 per 1,000 in the following decade. There was no cholera in 1880, and in 1881 the cholera death-rate was 1·08 per 1,000.

These examples will be sufficient to show that taken generally there has been a marked reduction in death-rates of late years, but that these rates have been liable to augmentation by wars, epidemics, and scarcity of food periods among the civil population; that the reductions have been most marked in certain districts; and that the military stations in the Punjab still require improvement. We shall next give a brief account of the principal death causes during 1881.

10. *Cholera.*—As already stated there were 137 deaths from cholera in the whole Indian Army in 1881, apportioned among European troops in the Presidencies as follows:—

Armies.	Total Cholera Deaths.	Cholera Deaths per 1,000 Strength.
Bengal	116	3·23
Madras	18	1·73
Bombay	3	0·30
Army of India	137	2·33

Of the 137 deaths, one took place on the march. Of 40 Bengal stations, seven had each a single death, two had three deaths each, two had four deaths each, and one had five deaths, one 13 deaths, one 17 deaths, and one station, Meean Meer, had 58 deaths. All the other stations, 25 in number, escaped the disease. Of 17 hill stations and depôts in Bengal Presidency a single death from cholera took place at Murree.

Of 16 stations in Bombay Presidency three yielded each a cholera death.

Of nine Madras stations only one, Kamptee, was attacked, und one station out of five in Burmah, viz., Thyet Myo, had four deaths. The facts appear to show that the cholera of 1881, so far as concerned British troops, was endemic in character.

11. The chief offender for many years, as regards cholera, has been Meean Meer, a station which was unfortunately formed on the site of an old Native cantonment, and it has been stated that wells and cesspits were both sunk in the same ground to the level of water-bearing strata. In the decade 1860 to 1869 the cholera death-rate at Meean Meer averaged 46·27 per 1,000. In the following decade it was 12·70 per 1,000. It escaped in 1880, and in 1881 the rate mounted up to 57·37 per 1,000 as already stated.

It requires no argument to prove that something very serious must be still at fault with Meean Meer, and if this cannot be discovered it becomes a question whether part of the station should not be removed to clean healthy ground. A similar remark applies to Kamptee and Thyet Myo.

12. The practical result of the history of cholera at stations of European troops is, that in the course of improvements at these stations a great reduction in the death-rate from cholera has taken place, but that the disease shows a tendency to periodical outbreaks at certain well-known stations. It is at these that special sanitary precautions should be taken, and if there are no known means of reducing the recurring mortality, the probability will be that the causes are topographical, and that there are such causes is well known in the history of cholera. The remedy in such cases is also well known, and this is simply leaving the locality.

13. *Small-pox.*—As is well known this epidemic disease prevails all over India, and fatal cases of it take place among European troops at stations in all parts of the country, but it never appears among them as an epidemic, and of late years the number of cases has greatly diminished.

Thus in Bengal there were in ten years, 1860 to 1869, 848 cases and 132 deaths from small-pox, giving a death-rate of 0·34 per 1,000 strength. In the next ten years, 1870 to 1879, the cases were 294, and the deaths 45, or 0·12 per 1,000. In 1880 there were seven cases and one death, and in 1881 there were four cases, none of which proved fatal. Corresponding data for Madras and Bombay commence with the decade 1870 to 1879, during which there were 55 cases and 10 deaths, equal to 0·09 per 1,000, among Madras troops. In 1880 there was a single case not fatal, and in 1881 there were nine cases and one death, or 0·10 per 1,000. The Bombay European army yielded 59 cases and five deaths in the same decade, a death-rate of 0·05 per 1,000 strength. In 1880 there were nine cases and three deaths, or 0·30 per 1,000, and in 1881 there were two non-fatal cases. It will be seen from these data that there has been a great reduction in small-pox attacks and deaths in the Bengal Army, while the amount of small-pox in the other two Armies has never attained so high a ratio as in Bengal, and there has been less room for reduction, but still the facts as they stand present points of interest, as they have all been supplied by vaccinated subjects.

14. *Fevers.*—Diseases classed under this head are by far the most important causes of death and inefficiency in the Indian European army. In 1881, out of an average strength of 58,728 men, there were the following admissions and deaths from different types of the disease:—

Fevers.	Admissions.	Deaths.
Enteric	328	155
Intermittent	34,149	4
Remittent	921	33
Continued	4,198	5
Total	39,596	197

These figures give for the whole European army an admission rate of 672 per 1,000 and a death-rate of 3·36 per 1,000.

15. The fever admission and death-rates were distributed among the Presidencies as follows:—

Armies.	Ratios per 1,000.	
	Admissions.	Deaths.
Bengal	770·2	3·43
Madras	279·6	0·77
Bombay	844·8	3·74

The most important fever in this group is enteric fever, so far as concerns its fatality, next in order follows remittent fever, and the deaths from the whole fever group amounted to the loss of two companies, although the year 1881 was by no means a fatal fever year.

16. In so far as regards general inefficiency paroxysmal fevers are the most important. The data under this head include admissions to hospital, and also re-admissions.

The following abstract from a table in the Sanitary Commissioners Report shows the relative prevalence of fevers in the three armies during the last 12 years:—

Periods.	Ratios per 1,000 Strength.					
	Bengal.		Madras.		Bombay.	
	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.
1870–79	612·6	4·02	270·4	2·04	663·0	2·89
1880	816·3	5·73	452·7	1·75	1,128·8	8·99
1881	770·2	3·43	279·6	0·77	844·8	3·74

These data show that the amount of fever varies considerably, and as the local causes remain much the same, there is reason to believe that climatic elements, such as rainfall, moisture, temperature variations, are the causes which determine the amount of fever, and the only means of neutralising these influences is by drainage and by attention to personal habits among the troops.

17. It is different, however, with the death-rates, for as we have seen these are mainly determined by the amount of enteric fever at the stations. We have so frequently dealt with the question of paroxysmal fevers, especially in our "Suggestions for the Sanitary Improvement of Indian Stations "and their vicinity" (1882), where we have given the relative liability of troops to intermittent fever at every station, that we shall limit the present discussion to the question of enteric fever.

The report under review contains much information on this fever, but it is mostly of a negative character. It is not denied by any of the reporters quoted by Dr. Cunningham that enteric fever may be connected with sanitary defects such as local filth causes, impure water, tainted milk and the like, but none of the reporting officers were able to trace the fever of 1881 to any such causes. In the words of the report applied to one of them, tainted milk, they appear to be "out of court." All we can do, therefore, is to analyse the present facts and see what they teach.

18. The following abstract gives the statistical history of enteric fever for the last 12 years:—

Periods.	Ratios per 1,000 Strength.					
	Bengal.		Madras.		Bombay.	
	Admission.	Died.	Admission.	Died.	Admission.	Died.
1870 to 1879	5·3	2·28	3·9	1·42	3·1	1·75
1880	8·7	3·07	2·5	1·26	9·5	5·76
1880	6·3	2·62	0·9	0·58	4·2	2·83

In discussing these data we must bear in mind that for some years the diagnosis of enteric fever in India was unsettled on account of the paroxysmal element in many cases, but we are afraid that in Bengal and Bombay the disease shows a tendency to increase. There has, however, been a decrease in the disease at Madras stations, and this fact is not due to transference of enteric fever cases under other heads, for the statistics show that in 1881 there was an absolute reduction in fever mortality.

19. If we assume the amount of fever as in some sense the result of atmospheric causes, we may be able to estimate the operation of these causes by ranging together the monthly admissions from intermittent fever with the monthly admissions for enteric fever for the whole Indian European army as follows:—

Months.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Intermittent	2,179	1,709	1,892	1,704	3,022	2,435	2,544	3,876	4,140	4,331	4,471	2,346
Enteric	15	13	28	32	56	33	21	37	28	24	24	17

There can be no doubt that these facts show great increase of intermittent fever during and after the rains when evaporation and variable temperature set in, but even making allowance for the smaller number of enteric fever cases, it can scarcely be said that the monthly proportion shows the same marks of the action of climatic causes as do the intermittent fever admissions. It would rather appear as if an increase of paroxysmal fever and of fever susceptibility also led to an increased liability to enteric fever, as part of the general fever history. It follows that, whatever may be the cause of enteric fever liability, it exists independently of climatic changes, except rise of temperature, which appears to increase the liability to attacks. On the evidence in the present year's report as it stands, we must therefore seek the causes of enteric fever prevalence elsewhere, and here we shall probably find a sufficiency of evidence to lead to practical conclusions, if we take into account not only the climatic and local conditions to which troops serving in India are exposed, but also the nature of the subjects exposed to their action, and these are healthy young men at periods of life when vitality is most vigorous, affording in these cases examples of many who, to all appearance, are the fittest for active life and its duties being cut off by enteric fever, while older men who have less life to spend, to a considerable extent escape its attacks.

Young ages are especially liable to fatal febrile attacks, so that the Indian experience is not singular, but there is this important difference, that, whereas among troops serving in the United Kingdom in 1880 deaths from fever (excluding eruptive fevers) were 26 per 1000, the fever death-rate among men of the same ages on Indian service, and excluding eruptive fevers, and in the same year was 6·51 per 1,000, in other words, for every man who died from fever in the Home army in 1880, no fewer than 25 died out of the same strength in India.

The losses from fever were less than in 1881, but this was an exceptional year, and below the average.

Out of this fever death-rate, enteric fever accounted for 3·63 per 1,000 in 1880, and for 2·64 per 1,000 in 1881. Statistical differences such as these frequently take place where both conditions and subjects are the same, and they do not invalidate the general experience that if a large proportion of healthy young men are sent to India, they will one way or another yield a much larger number of fever deaths than will men of more mature ages, and this well-known fact brings us to the question of ages in the Indian Army, and their bearing on its efficiency.

20. This subject we have discussed year after year, and we have long since arrived at the conclusion, that the way to keep up the fever death-rate in the Indian army is simply to fill up the ranks with short service young men. The subject is fully discussed by the Sanitary Commissioner in the present Report, and he has given the following table to show the gradual deterioration of the army in the matter of age:—

Year.	Under 25.	25 to 29.	30 and upwards.	
	Per cent.	Per cent.	Per cent.	
1871 to 1875	38	27	35	= 100
1876	33	33	34	= 100
1877	33	35	32	= 100
1878	35	36	29	= 100
1879	39	33	28	= 100
1880	41	34	25	= 100
1881	43	35	22	= 100

Liability to fever is determined not only by age, but by length of residence in India, and the next table gives the constitution of the army under this head.

	Per-centage of Men to total Strength who have served in India two, five, and seven years, 1871–81.		
	Two Years and under.	Five Years and under.	Seven Years and under.
1871	36·2	64·6	78·9
1872	33·7	66·7	80·0
1873	31·7	65·5	79·6
1874	25·9	64·3	79·3
1875	26·1	60·1	81·0
1876	25·5	57·6	75·1
1877	24·2	56·2	72·6
1878	28·9	59·8	78·0
1879	32·1	60·9	72·6
1880	33·4	65·4	77·2
1881	38·9	70·8	81·1

It is clear from these abstracts that, while the numbers of men in the Indian army at the younger ages have been increasing, the proportion of short service men has also been increasing, so that what may be called the two fever elements, youth and brief residence, have been on the increase, and we shall next see what the results of both is on the amount of enteric fever.

Years.	Mortality from Enteric Fever and Ratio of Liability to it at different Ages.					
	Under 25.		25 to 29.		30 to 34.	
	Deaths per 1,000.	Per-centage of Liability.	Deaths per 1,000.	Per-centage of Liability.	Deaths per 1,000.	Per-centage of Liability.
1877	2·45	44·2	1·55	27·9	0·99	17·8
1878	6·04	53·0	3·55	31·1	1·04	9·1
1879	6·17	54·1	2·78	23·9	1·78	15·6
1880	6·25	56·26	3·15	28·35	1·09	9·81
1881	4·56	59·84	1·57	20·60	0·79	10·37

It thus appears that the per-centage of younger ages has been increasing since 1877, the healthiest year ever attained to by the Indian army, as one consequence of the short service system, and that the liability to enteric fever, leaving out the exceptional year 1881, has been doubled or more for the younger ages. In 1877, the per-centage of ages under 25 was 33 per cent., and the liability to enteric fever was 44·2 per cent. In 1880 the per-centage of ages under 25 had risen to 41, and in 1881 to 43, while the per-centage of liability to enteric fever had risen to 56·26 and 59·86 in these years respectively.

21. The next tabular abstract shows the effect of residence on liability to enteric fever.

Years.	Mortality from Enteric Fever and Ratio of Liability to it at different Periods of Residence in India.					
	1st and 2nd Year.		3rd and 6th Year.		7th to 10th Year.	
	Deaths per 1,000.	Per-centage of Liability.	Deaths per 1,000.	Per-centage of Liability.	Deaths per 1,000	Per-centage of Liability.
1877	3·31	59·5	1·85	24·2	0·90	16·1
1878	7·90	68·4	2·64	21·2	1·38	11·0
1879	7·99	67·2	2·18	18·3	1·24	10·4
1880	9·08	75·98	1·78	14·90	0·47	3·98
1881	4·55	60·02	2·07	27·31	0·56	7·39

This table, with those that have already been given, can leave no doubt on the mind that, whatever may be the influence of local and climatic causes in predisposing to enteric fever, the subject, the young soldier, is the main death cause, and that to attain the highest enteric fever death-rate it is only necessary to send him to India and bring him back under the short service system. The statistical evidence would further appear to show that the lower enteric fever death-rates at older ages and longer periods of residence may be partly due to the dying off by fever of the more predisposed subjects in the earlier years of service.

The amount of fever and of fever liability will no doubt vary in some years, but with the present terms of army service this fatal fever will form an important item in the Indian army death-rates.

This is the result of long past, as well as of present experience, and all that can be done of a practical character is to try to diminish liability in young soldiers first landing in India, by having drill completed before landing in India, by exercising great care over the habits of these young men until they are accustomed to the climate, by placing as many of them as possible at hill stations, and by rigid attention to every local sanitary precaution. The need for this last recommendation appears to be shown by the fact that there are stations scattered all over India in all varieties of Indian climates and temperatures, at which the amount of enteric fever is much greater than at others. We have given a table, published in Vol. XI. of the India Office Sanitary Reports, giving the enteric fever deaths for seven years at all stations of European troops.

The stations at which troops are most exposed to attacks of this fever are Peshawar and Cherat, Neemuch, Meerut, Secunderabad, Bangalore, Lucknow, Fyzabad, Kurrachee, Nusseerabad, Hazareebagh, Mhow, and others. These names are selected to show that liability to this fever is not only general, by its almost universal appearance, but local, as shown by the number of deaths at certain stations.

22. In 1881, fatal cases of enteric fever occurred at 23 stations of European troops out of 39 in the Bengal returns, also at seven hill stations and depots out of 16 in the same Presidency. In Bombay and Madras, including Burmah and hill stations, enteric fever deaths took place at 11 stations out of 33, so that this fever took its victims from among European troops at 41 stations out of 88 in the returns. Of the 41 attacked stations 17 yielded one death each, 10 yielded two deaths each, and eight had three deaths. The largest number of deaths were furnished by Lucknow (13 deaths), and by Poona and Kirkee (10 deaths). But the deaths scarcely give a sufficient account of the facts. For example, there were 46 cases of the fever at Lucknow, 14 at Bareilly, 12 at Meean Meer, 15 at Rawul Pindi, 10 at the hill station of Ranikhet, and 16 at Poona and Kirkee. The disease was most prevalent at stations in the north-west of India, and it would appear as if some light might be thrown on this fact by examination into ages, temperatures, and local sanitary conditions at these stations. Lucknow is an old offender. Enteric fever appears to be endemic there, and the

cause of this fact has never yet been satisfactorily shown. All we can do is to call attention to the facts, and also to the circumstance that where enteric fever is connected with local causes it is not necessary that these causes should be of so prominent a character as to attract immediate attention. The continued action of not very evident cases may determine the occurrence of fever cases. In England filth at a considerable distance from barracks has led to fever cases.

23. In a previous table we have shown the past and present statistical history of apoplexy, hepatitis, and dysentery. Generally the mortality from all three has diminished, and no doubt the reduction will continue if spirit drinking be abolished, and the men take better care of themselves.

24. *Venereal diseases.*—These yielded an admission-rate of 260 per 1,000, as the result of 16 years' operation of Contagious Diseases Acts. The ratio was the highest on record with the exception of 1878. The Acts have failed in India to protect the health of troops from venereal diseases, and the whole subject is now under consideration by the authorities in India.

25. *Invaliding.*—We have already given the invaliding rate for Bengal as 37 per 1,000, for Madras at 28 per 1,000, and for Bombay at 53 per 1,000. The excess in Bombay is accounted for by the fact that a larger proportion of men are sent home from Bombay, for comparatively slighter causes than from the other Presidencies.

In Bengal the invaliding rate has fallen almost continuously from 50·41 per 1,000 in 1870, to 36·92 per 1,000 (including Afghanistan troops) in 1881.

In Madras Presidency the invaliding rate, which was 78·93 per 1,000 in 1870, was 27·91 per 1,000 in 1881, but, for the reason stated above, the invaliding rate in Bombay, which was 29·17 per 1,000 in 1870, was 53·35 per 1,000 in 1881, a rate which also includes the Afghanistan invalids.

As a whole, the invaliding has decreased with improved army health. The chief causes of invaliding were anæmia and debility, hepatitis, diarrhœa and dysentery, and phthisis. Young men under 25 years of age yielded 33·74 per cent. of the total nnmber invalided.

The influence of new arrival on the death-rates was clearly shown in 1881. In the army generally the death-rate from all causes was 16·86 per 1,000, while among newly arrived regiments it was 23·64 per 1,000. And enteric fever, the death-rate from which in the army generally was 2·64 per 1 000, attained a ratio of no less than 10·65 per 1,000 in newly arrived regiments. As these regiments are composed mostly of youths new to Indian climates and conditions of service, we can easily understand why young ages suffer and raise the general death-rate.

26. *Women and children.*—In 1881 there were 3,741 women and 6,548 children at stations in India. The death-rate among women was about the average, namely, 25·93 per 1,000, and the death-rate among children was 60·17 per 1,000, also about the average. Of children's deaths no fewer than 55·57 per cent. took place under one year of age.

The chief death causes were:—

	Deaths.
Convulsions	64
Diarrhœa	53
Anæmia and debility	41
Bronchitis and pneumonia	41
Measles	32
Dentition	31
Remittent and continued fever	28
Tabes mesenteriea	24

The total deaths were 394, and only two were ascribed to scarlet fever.

27. *Officers.*—The strength of British Officers in India was 1,532, among whom there were 26 deaths. There were 1,303 Indian Officers, of whom 14 died. There were besides 878 officers of both services out of India, among whom 30 deaths took place.

The death-rate of these 3,713 officers was 18·85 per 1,000. Four of the deaths in India were from remittent fever, and three from enteric fever. Six deaths were accidental, and one a suicide.

28. *Native Army.*—The average strength of the Native army in 1881 was 114,612 men. The admission-rate was 1,305 per 1,000, against a five years' mean of 1,422 per 1,000. The daily sick were 46 per 1,000, and the mortality, including absent deaths, equalled 22·62 per 1,000, or 4·78 per 1,000 under the five years' average.

The following were the chief admission and death causes during the year:—

	Admissions.	Deaths.		Admissions.	Deaths
Cholera	208	111	Phthisis pulmonalis	334	87
Small-pox	116	12	Dropsy	157	34
Enteric fever	20	11	Scurvy	903	27
Intermittent fever	71,860	86	Anæmia and debility	—	130
Remittent and continued fevers	1,668	219	Rheumatism	5,001	—
Apoplexy	105	40	Eye diseases	2,964	—
Dysentery and diarrhœa	10,220	300	Venereal diseases	4,526	—
Hepatitis	257	19	Abscess and ulcer	2220	—
Spleen disease	1,184	22	Wounds and accidents	12,414	27
Respiratory diseases	9,027	747	Guinea worm	556	—
Heart diseases	—	49	All other causes	15,138	—

This tabular statement is not only of importance as showing the inefficiency causes in the Native army, but it gives the absolute diagnosis by skilled medical officers of the relative amounts of different diseases among a native population where the facts have been properly tested, and some of the facts revealed by it are worthy of notice.

29. For example, admissions for intermittent fever among Native troops born in the country averaged 627 per 1,000, while among European troops the average was 581·5 per 1,000. The strangers were less susceptible to Indian fevers than the natives. Again, the total fever mortality among European troops, 3·36 per 1,000, exceeded the mortality among Native troops, which was 2·76 per 1,000. But the enteric fever mortality, which was 2·64 per 1,000 among European troops, did not fall far short of the total fever mortality among natives. If we deduct the deaths from enteric fever, which is not specially an Indian fever, the rates would stand for Native troops about 2·75 per 1,000, and for European troops ·72 per 1,000, showing that except for superadded enteric fever European troops suffer a far lower fever mortality than Native troops. The Native army is much more liable to diseases of the respiratory organs than are European troops. In the former the conjoined death-rate from respiratory diseases, including phthisis pulmonalis, was 7·28 per 1,000, while among European troops the same conjoined rate was 2·51. In the European army the death-rate from hepatitis was 1·60 per 1,000, and from dysentery 1·72 per 1000, while in the Native Army the death-rate from the former disease was ·17, and from the latter, 1·30 per 1,000. Of the two most prominent Indian epidemics, cholera and small-pox, the European Army had a death-rate from the former of 2·33 per 1,000, and from the latter of ·02 per 1,000; while the cholera death-rate of the Native army was ·97 per 1,000, and the small-pox death-rate was ·10 per 1,000. Both armies are subject to rheumatism nearly to the same extent. The admission-rate from this disease among European troops was 47 per 1,000, and for the Native troops 52 per 1,000. But in no particular do the admission-rates vary so remarkably as in the case of venereal diseases, which furnished 39·5 per 1,000 among Native troops and 260·5 among European troops. These contrasts are very important, because they afford indications towards improving the health of both armies. Reduction of malarial causes would improve the health of both, but the Native soldier should be better lodged, and in both armies more attention is required in the matter of clothing, especially at night. Improved regimen and better habits would improve the health of European troops when in India, but enteric fever mortality must be reduced by sending an older army on Indian service.

30. These remarks apply to both armies generally, but when stations or groups of stations are taken, native stations and individual regiments present striking differences in death-rates, showing the influence of the locality and local climatic causes.

For example, the death-rate among Native troops in 1881 from respiratory diseases in the Gangetic provinces was 2·20 per 1,000, but in the Punjab the death-rate was 10·13 per 1,000, marking the influence of low and variable temperatures, and pointing to the need of suitable shelter and clothing to counteract the influence of climate changes.

Again, take the following stational death-rates in 1881,—Fyzabad 50·82 per 1,000, Nowshera 53·18 per 1,000. At Fyzabad the death-rate in 1880 was no less than 96·97 per 1,000. The mortality was chiefly due to malarial disease. Bengal Native troops serving in Afghanistan lost above 10½ per cent. of their number.

Take again a few of the Madras stations. Trichinopoly had a rate of 41·49 per 1,000 in the 6th Regiment there. The 14th at Dolunda had a ratio of 68·55 per 1,000, and at Rangoon the 11th had a death-rate of 49·50 per 1000.

In the Bombay Native army similar diversities in death-rates present themselves.

Taking the various divisions of the Native army, we obtain the following sick and death rates for 1881:—

Presidencies.	Daily Sick per 1,000.	Deaths per 1,000.
Bengal Native Army - -	52	23·84
Ditto, excluding Afghanistan -	51	19·76
Madras Native Army - -	41	12·02
Bombay Native Army -	50	25·58
Ditto, excluding Afghanistan -	47	14·01
Central India Regiments -	26	12·14
Punjab Frontier Field Force -	55	17·95
Hyderabad Contingent -	24	·7·78
India - - - -	46	19·24

These ratios do not, however, represent the total deaths, for many deaths take place on leave. The ratios, however, show us the sanitary problems to be dealt with at the stations; in regard to which much useful information is given by the Sanitary Commissioner in a tabular summary of sanitary sheets from each regiment.

There are 224 of them, and they include nearly every possible sanitary defect in Native lines and quarters, differing of course in number at different stations, but including more or less bad hutting, want of ventilation, crowding, want of drainage, marshy wet jungly ground, pollution of ground by sewage, sleeping on the ground, and similar defects.

These disease causes are stated as facts, not as opinions. We are bound to accept them on the evidence of medical officers who have drawn up the reports, and in concluding these remarks on the Native army and its disease statistics, we would strongly advise that the facts regarding insanitary

condition which the Sanitary Commissioner has collected should be acted on at once, for it is not too much to say that, after years of professed improvements, no such statements should have been forthcoming.

31. *Jails.*—The average strength of prisoners in all the jails during 1881 was 100,844, distributed among 259 jails within the jurisdiction of the various Governments of India and Burmah. Among these prisoners the average number of daily sick was 4,529, or 4·49 per 1,000 strength; the number of deaths 4,440, or 44·03 per 1,000 strength. The following were the chief admissions and death causes during the year:—

Diseases.	Cases.	Deaths.
Cholera	564	306
Small-pox	92	8
Enteric fever	22	14
Intermittent fever	52,382	131
Remittant and continued fever	1,968	241
Typhus 2	330	89
Diarrhœa	2,854	726
Dysentery	2,145	978
Hepatitis	108	28
Spleen diseases	1,009	15
Respiratory diseases	5,667	690
Phthisis pulmonalis	584	271
Dropsy	502	151
Anæmia and debility	3,842	284
Wounds and accidents	6,087	66
Abscess and ulcer	15,394	—
All causes	122,409	4,440

This abstract shows clearly the influences direct and indirect, or secondary, of malarial locality and malarial conditions, the depressing effects of prison life and its surrounding, the influences of variable climate and temperature range, possibly augmented by want of suitable clothing to meet it, and adequate shelter in some cases to provide against cold night blasts, and possibly also inappropriate diet. But in so reading the statistics, the previous life, history, and conditions of prisoners, and their liability to similar diseases before committal, must clearly be kept in view, because unfavourable as the statistics unquestionably are (when we bear in mind that prisoners ought as far as possible to be exempt from special causes of high mortality), the disease and death causes themselves are precisely those from which the same people suffer often very severely out of prison.

32. The next abstract shows the strength and mortality for the last 10 years:—

Years.	Average Strength.	Deaths per 1,000 all Causes.
1872–76	99,758	36·24
1877	110,147	61·25
1878	127,914	81·31
1879	117,680	73·73
1880	106,763	46·31
1881	100,844	44·03

It will be observed that in this series the death-rates rose with the increase of prison population, and that the ratios have fallen with decrease of population. At first sight this fact apparently points to the effect of crowding more prisoners into existing prisons, and it would be condemnatory of this practice did we not know that 1877 and 1878 were years of famine and scarcity, the effects of which lingered among the population after food had become sufficient. From this point of view the health of prisoners appears to have followed the health of the outside population, so that the real question at issue is why the 100,844 persons of adult years and under control of educated officers present such high death-rates.

If we eliminate the famine year 1877, as representing not only prison mortality but famine results, we can distribute the death-rates as follows:—

Presidencies.	Period.	Average Numbers.	Deaths per 1,000.
Bengal	1872–76	68,328	39·03
	1878	78,116	65·85
	1881	63,478	44·42
Madras	1872–76	9,667	22·37
	1878	21,345	125·92
	1881	10,332	41·91
Bombay	1872–76	8,011	26·61
	1878	13,139	118·27
	1881	9,910	41·88

This abstract shows the influence of scarcity still prevalent in 1878 all over India, and also the special effects of famine in Madras and Bombay in the same year. There was a great influx of prisoners who committed offences to obtain admission and food, but during the third year after the famine the figures show that the prison mortality was resuming its normal amount.

33. The statistics of individual jails present the usual diversities. The lowest rate of the year was that of Dhulia jail in Bombay Presidency, in which out of 254 prisoners the admission-rate was 449 and the death-rate 3·94 per 1,000. In a considerable number of jails the death-rates can scarcely be called high, but there are instances in which rates are excessive; we shall only name those in which the death-rates exceed 10 per cent., they are as follows:—

Jails.	Average Strength, 1881.	Deaths per 1,000, 1881.
Midnapore	1,015	125·6
Dinagepore	175	177·14
Scoty	179	145·25
Nuddea	275	102·56
Bogra	185	102·70
Mymensingh	463	153·35
Cummparun	421	199·53
Purneah	130	107·69
Baraset	182	203·30
Darjeeling	89	123·60
Jalpaiguri	108	277·78
Gorakhpur	638	180·09
Dharmsala	134	253·73
Lahore Central	1,964	157·33
Rawul Pindi	686	195·33
Peshawur	720	127·78
Thyet-Mye	400	167·50
Henzade	109	119·27
Tanjore	145	165·52
Trichinopoly Central	1,080	121·36
„ District	153	130·72
Surat	209	138·76
Gokak Camp	461	112·80

Some of these most unhealthy jails contain only a small number of prisoners, among whom a death or two makes a tolerably high per-centage, but there can be no doubt that this record of mortality is a very sad one, and calls for earnest effort to abolish it. Besides the sick and death-rates each jail report is accompanied by an abstract of sanitary sheets sent in by the jail officers. The majority of these abstracts state distinct and specific sanitary defects, such as overcrowding, temporary overcrowding, defective drainage, bad or deficient ventilation, malarial surroundings, bad locality of prison, often suspicious or bad water, defects in latrines leading to nuisance, water-logged subsoil, defective clothing during cold season, jail diet complained of in one or two cases. These abstracts leave an impression that, admitting the necessity for sanitary works and measures so clearly pointed out in the reports, much might be done to remedy the existing defects by vigorous administration and oversight. We are glad to learn from the Report that the whole subject has been placed in the hands of a special committee, who will doubtless go to the root of the evils, and propose remedies, and we must wait the result of their labours.

34. There are some remarks by Surgeon-Major James Reid in reference to causes of sickness among prisoners at the penal settlements of the Andamans and Nicobars, which are of much interest, as throwing light on the causes of malarial fevers in tropical climates, and also of bowel diseases. The fundamental facts are as follows:—

Convict Settlements, Andamans.

Years.	Average Strength.	Deaths per 1,000.	
		Dysentery and Diarrhœa.	All Causes.
1877	9,099	5·29	34·30
1878	9,521	17·13	59·79
1879	10,075	6·75	47·54
1880	10,976	14·57	49·65
1881	11,225	15·86	48·02

In dealing with the causes of these death-rates, Dr. Reid says:—"There is no question here of "improper or insufficient dietary, of want of attention to conservancy, of impure drinking water, or "of deficient air, space, or ventilation.

"The great and permanent cause of sickness here is the malarial unhealthy nature of the stations on "which convicts are located. . . . Of all causes of sickness here, this is the most important "and far reaching in influence."

In Ross Island the death-rates have ranged between 8 and 21·3 per 1,000, but there is this important difference in this station as compared with the others, that "convicts living on Ross, "though employed in hard enough labour and on exposed out-of-door labour for the most part, are "not employed on certain forms of labour which men living on feverish stations have to perform "swamp reclamation, brick-making, lime-burning, &c. The worst results as regards health," he says, "are obtained when we have the three following conditions combined:—(*a*) exposure during the "rainy season; (*b*) residence on a feverish station; (*c*) employment on swamp or jungle work or "forest work generally."

Besides the production of fever, work of this class gives rise to ulcers, which have a tendency to become gangrenous; and, as usually happens, fresh clearings lower the standard of health of all living on them or near them. The following instructive data from one of the hospitals on Viper Island, which was formerly remarkable for its healthiness, shows the result of mangrove swamp reclamation on the adjacent main land:—

Months, 1881.	Fever Admissions.	
January	87	
February	72	
March	51	
April	45	
May	204	Reclamation work commenced.
June	207	1st bund started.
July	284	
August	190	
September	247	Second bund started.
October	217	
November	352	Rainfall, 15·27 inches.
December	192	

35. Experience such as this has often been repeated, but it has generally been taken as a matter of course, although it is a part of sanitary practice so to conduct such work as to diminish the unhealthiness resulting from it. The subject was dealt with in the report of a commission sent to Algeria by the Marquis of Ripon, when Secretary of State for War in 1865–66, and in their report they give an account of the reclamation and draining of lake Hallula, during which about 34,000 acres of land were reclaimed. In the course of the work there was great mortality, as the people engaged in it had to work up to their middle in water, and to drink the muddy water of the lake. In the course of time it was found that providing good water, hutting the workpeople away from their work, attending to diet, and stopping the works from June to December, diminished the mortality. "The older "colonists in the neighbourhood agreed that although the first work of clearance and cultivation is "invariably attended by fever, much of the sickness could be avoided by selecting the proper period "for clearing and draining, namely, the colder season, leaving the land to be baked during the "summer heats, previous to actual cultivation, and by sanitary precautions. These consist in "avoiding commencing work till the sun has risen, the use of generous diet, careful selection of "drinking water, good clothing, ablution and change of clothing after work, not living in close "vicinity to the work itself, and frequent use of coffee. With these precautions they asserted that "the clearance of waste land, and bringing it under cultivation, was not attended with serious risk "to health." The preceding abstract of fever cases in Viper Hospital shows that the working time there is precisely the time which Algerian practice had shown to be the most dangerous. We have no means of knowing to what extent fever mortality, attributed to Indian jails, may be due to gang work conducted without precautions as to times and methods, and all we can do is to call attention to the experience, and at the same time to state the very obvious principle, that to employ prisoners in such a way as that they shall die of diseases produced by want of suitable precautions of the class we have named, is simply to add a death penalty to the sentence of imprisonment.

36. *General population.*—The year 1881 was the census year all over India, and the total population enumerated was composed of separated sexes, as follows:—

Males	123,211,327
Females	118,166,371
Total	241,377,698
Sexes not separated	11,005,512
Total population	252,383,210

A few other details bring up the census number to 252,541,210. But this total includes the population of Native States. The actual population of the 17 provinces was 218,559,918. Previous census enumerations had been made at irregular periods in different States, and according to these data the census numbers of 1881 showed an actual increase in population of these provinces of 12,788,565, or 6·2 per cent. The following table gives the details of registration in 1881:—

Provinces.	Population under Registration.		Deaths per 1,000.		
	Rural.	Towns.	Rural.	Towns.	Total.
Bengal	57,523,332	2,355,165	20·45	33·47	30·95
North-West Provinces and Oudh	41,369,081	2,738,788	31·39	37·80	31·79
Punjab	16,134,245	1,299,686	28·00	48·00	30·00
Central Provinces	6,926,283	488,582	32·02	40·65	32·59
Berar	2,491,640	138,378	29·20	28·40	29·10
British Burma	3,277,734	214,529	14·25	27·43	15·75
Assam	4,425,692	58,018	15·95	23·46	16·04
Madras	27,178,076	1,498,299	15·80	22·80	16·20
Bombay	14,851,769	2,192,645	28·32	29·07	23·18
Mysore	3,933,411	252,777	17·06	16·24	17·02
Coorg	169,919	8,383	18·21	11·69	17·90

It will be seen that the ratios in this table set forth, not so much the actual facts as the state of registration in each province, but they also show that this important branch of sanitary work is gradually improving.

The next abstract gives the total deaths from the chief disease causes in these provinces for 1881 :—

Provinces.	Cholera.	Small-pox.	Fever.	Bowel Complaints.	Injuries.	All other Causes.
Bengal	79,180	24,371	940,911	37,029	21,555	132,332
Assam	3,010	3,129	42,553	9,865	934	10,450
North-West Provinces and Oudh	25,865	17,153	1,109,599	33,814	21,060	154,932
Punjab	5,207	6,749	855,279	17,281	5,695	129,563
Central Provinces	9,149	1,214	143,933	22,133	3,957	60,488
Berar	3,404	225	41,681	11,951	969	18,431
Bombay	16,694	539	272,405	30,342	5,930	55,529
Madras	9,446	15,776	203,543	23,361	11,527	206,430
Mysore	25	2,566	43,342	4,844	1,094	18,869
Coorg	3	63	2,807	122	39	158
British Burma	5,239	1,763	27,743	3,808	523	19,057

With the addition of 2,499 deaths from cholera in Rajputana, Central India, and Hyderabad, the death causes for 1881 were as follow for all India :—

Diseases.	Deaths.
Cholera	159,213
Small-pox	74,153
Fevers	3,184,293
Bowel complaints	259,150
Injuries	73,403
All other causes	806,287
All causes	4,556,499

These numerical results are the best at present attainable, and such as they are, they show how very subordinate a part cholera plays in Indian death registration. Deaths ascribed to fever are by no means all due to this cause, for they include many inflammatory diseases.

Deaths ascribed to "injuries" included in 1881 no fewer than 22,377 deaths from snake-bites and wild animals.

37. As the disease history of each province has been discussed by us on other memoranda, it is unnecessary to enter further on this subject, except to notice certain points of cholera history, which have been dealt with by Dr. Cuningham in the present Report.

The first fact is one of considerable importance, and it is as follows :—

From a table given in the Report, it appears that while the total deaths from cholera among the civil population during the four years 1874 to 1877 had been 1,556,754, the total deaths during the four succeeding years, 1878 to 1881, had been 868,132.

The following is an annual abstract of this table :—

Years.	Cholera Deaths.	Years.	Cholera Deaths.
1874	81,222	1878	318,228
1875	384,421	1879	269,336
1876	455,134	1880	118,856
1877	635,977	1881	161,712
Total	1,556,754	Total	868,132

These facts correspond to the decline of cholera mortality in the army, and are not only hopeful, but the one agency which has been in operation at the same time has been attention to sanitary

work, which has been extending, and it is not unreasonable to connect this work with decline of cholera. We reported a year or two ago a municipal town in Madras Presidency, where cholera had been extinguished by cleansing and good water. Moreover, we have the experience of sanitary work at fairs as additional evidence, and it seems justifiable to press as strongly as we can for the advance of sanitary work in all towns and villages, as the only safeguard against this epidemic. This view, however, is not held as it ought to be by all persons charged with sanitary duties, and in the present Report Dr. Cuningham again calls attention to the interference of contagion doctrines with obvious sanitary work.

38. Some years ago the then Sanitary Commissioner for Assam explained the occurrence of cholera on board coolie steamers on the Brahmahputra by the theory of impure drinking water. It was never proved that the water then used was impure, nevertheless precautions were taken to secure perfectly good water for the coolies; but cholera reappeared, and this fact led to further inquiry, and it has been found that the amount of cholera among coolies has no reference to the water, but that it has a very distinct relation to the amount of cholera in the districts through which the coolies pass, suggesting that during the cholera period this passage should be avoided. The contagion theory imputed the deaths to some imported infection on board ship, and is suggestive of quarantine, regarding which Dr. Cuningham very properly remarks that, "when bodies of men have to pass "through cholera infected localities, they should do so rapidly; any attempt at quarantining them "in such a territory would be cruel."

39. When cholera was prevalent in Jullunder and its vicinity, the officer commanding put the cantonment in quarantine, which was countermanded by Government, and (instead of it) men were prevented going into affected places, and the cantonment "almost wholly escaped." In this case, had there been quarantine, it would, of course, have got the credit of this result.

Thyet-Myo is a cholera locality, and, nevertheless, to keep cholera out of it, the officer commanding wished to establish what was quarantine in reality against river steamers, a proposal which the Government very properly set aside.

In our memorandum on the report of the North-West Provinces and Oudh, we have discussed the great Mela at Allahabad in June 1882, and the cholera which appeared at it. An important question raised at the time was the extent to which the disease had been carried away by returning pilgrims. In the present report, it is stated that cholera prevailed extensively before the first case at Allahabad; but, as we have stated in the memorandum referred to, we must wait for all the facts.

40. Some points of interest are stated regarding the occurrence of cholera among European troops.

"At Meean Meer the weather is described as having been hot and cloudy. A sand-storm passed over the station at the period of outbreak, and there was also a little rain, followed by that peculiar and characteristic graveyard odour after early showers of rain in hot weather."

Is not this atmospheric state one of the results of subsoil pollution by long occupation of the site before a European cantonment was formed?

The following instance may be cited to show the evil of accepting postulates instead of facts in dealing with questions of etiology; it refers to a case of cholera at Jullundur:—"It is supposed that "the infection was imported by the Royal Artillery dooly bearers, who slept in the verandah of "the guard-room, under the window of the day-room where the prisoner was confined."

41. The Sanitary Commissioner has imported a new statistical element into the infection question, by calling for returns of the number of buildings in which cholera had appeared. Returns were received from 10,500 barracks, jails, asylums, &c., in 335 of which only did cholera appear. This is an extension of the village inquiry, and has led to similar results, namely, that a very small number of groups suffer, in the present case about 3 per cent.; but the number of cases differs greatly in different groups of buildings, as in the case of villages. The attacks in both cases are individual and local, and there is no spreading, as of a fire.

Further experience regarding liability of attendants to cholera attacks gives the following results for 1881, all attendants and cases, of course, being housed in cholera localities:—

Cases of cholera - - - - -	861
Number of attendants - - - -	1,746
Attendants attacked - - - - -	36

During the five years 1877—1881, out of 7,859 attendants on cholera cases, 149, or 1·9 per cent., were attacked. Seeing (as already has been stated) that all these people were in cholera affected localities at the time, this experience ought to counterbalance mere opinion on individual cases of supposed infection. The experience all shows the local nature of cholera outbreaks, and this view is further sustained by experience in moving troops, which appears to have been successful in arresting cholera in 1881. There is one exception at Meean Meer, which goes to prove the rule. We have already noticed the character of the site. In this case, "the first move was not successful, having been "only a short distance from the barracks, but movements to a distance" (*i.e.*, away from the site) "along the line of rail towards Mooltan, were attended with complete cessation of the disease;" and the necessity in every case of knowing the nature of the locality as regards cholera liability is proved by absence of satisfactory results in some cases at first, where the movement has been still within the cholera zone, and by the recurrence of cholera, in the Meean Meer example, twice over in moving again within the site, and the disappearance of the disease on return to camp. It would appear as if the question of cholera ought always to be considered together with the question of locality.

42. A discussion of another kind is raised by the Sanitary Commissioner on the assumed importation of cholera into Aden from Bombay by the "Columbian," which led to quarantine at Suez.

The facts appear to have been as follows:—

The "Columbian" left Bombay on the 17th or 18th July 1881, and the cholera history in Bombay city up to that time was as follows. There were no deaths in January or February. There were two deaths in March, nine in April, 68 in May, 85 in June, and 121 in July; August yielded 78 deaths and the disease declined. The greatest fatality in July took place in the first two weeks, as stated by the officer of health, and throughout the quarter, July, August, and September, he says, "the "disease was generally distributed in small groups over the city." On 29th July a stoker on board the "Columbian" died of "colic," or while ill of "fever." Nothing further known about the case. Another of the crew had previously died on board, but the cause of death was unknown.

Three days after the first death the "Columbian" arrived at Aden. The ship remained a week there without any sickness on board; she sailed for Jeddah, where she landed pilgrims, and returned to Aden and Bombay without sickness. This vessel was one of multitudes of ships which have put in at Aden from India at all times and seasons, and when cholera prevails in all degrees of intensity there, without any suspicion of importation. Why then was the "Columbian" blamed for Aden cholera, especially as Aden has been visited several times with cholera without suspicion attaching to trading and passenger vessels? As we have stated the facts regarding public health at Bombay before the departure of the "Columbian," we shall state the corresponding facts about Aden before her arrival there.

There had been great mortality among starving Soumalis who had come from the African coasts. In June 1881 there were 161 deaths registered in Aden, against 89 in 1880, and 54 in 1879. In July the deaths rose to 209, as compared with 75 in 1880 and 64 in July 1879. The mortality was so high that Government attention was called to it, and a special inquiry had been instituted into its causes, which were for the most part dysentery and diarrhœa. In this state of public health the "Columbian" brought rice in bags, and as such a cargo could not introduce cholera anywhere, "the "Committee are of opinion that some of the bags containing the rice cargo of the 'Columbian' had "been tainted by cholera discharges at Bombay." This it will be seen is simply a postulate to enable the Committee to bring the cholera from Bombay, but there is absolutely not a shadow of proof to sustain it.

The case virtually ends here, but it is necessary to state what occurred afterwards.

On 1st August 60 coolies were engaging in discharging the cargo. On the evening of the 2nd, 68 coolies were thus employed. Next day, 3rd August, the port surgeon reported to the Political Resident that seven cases of cholera or of a disease closely resembling it had occurred amongst the coolies who had been unloading the cargo. On the same day two other cases among coolies took place, all living in the same village. All the attacked, except two, had been in the hold. These cases, it will be observed, took place within say 24 to 36 hours after presumed exposure to the cause. They took place in men living in Tawahi (Steamer Point). But there were other coolies engaged in the ship who lived in another village, Maala, and none of these were affected.

On the 4th August a Somali female was attacked at Tawahi without any communication with affected persons.

For a week after this there were no more cases, but on 12th August a Somali woman was attacked at Maala and died next day. This was the first case in the village. There were altogether 109 cases in this village, only five of which were among coolies; they took place mostly among women and children. There were only 35 attacks in males above 15 years of age.

The information in the Committee's report is very incomplete, and scarcely justifies any conclusions from it. But we are enabled to supplement it to some extent by the following facts about Maala, on which the force of the endemic fell, given by the Surgeon-General in his report on the Bombay Army. He says the insanitary state of Maala requires immediate attention. "The population of this village "consists of the poorer and ill-nourished classes, and is being constantly increased by the arrival of "destitute people from the mainland. The houses are reed and mat structures, each one having its "cesspool, and there are large burial grounds not far off. As a consequence of this undesirable state "of things, Maala is a place where contagious maladies usually originate and to which they cling "longest." The Deputy Surgeon-General considers this place is a "standing menace to the health "of the garrison."

At Tawahi, about which no information is given, out of 48 cases, 33 were adult males. But it has not been satisfactorily shown that the first case there had any connexion with the "Columbian," and he is not included in the list of men employed on board.

It is evident that in the way of coincidence there was an apparent relation between the arrival of the "Columbian" and the subsequent cholera, but in all evidence of this kind errors must be carefully eliminated, and before the coincidence could become of value it would be necessary to show that the striking exceptions to it were all applicable on the cholera poison importation theory, and then we should have to leave out the previous diarrhœal sickness and death among the people, and the filthy state of the villages as probable exciting causes of cholera. The evidence, as it stands, must lead to a verdict of "not proven," and whatever opinion may be formed of this case, of one thing there can be no doubt, namely, that the "Columbian" did not go to Suez, and was not quarantined, and that the quarantining of other ships at Suez was altogether unjustified by the facts regarding the "Columbian" at Aden.

These Somali villages at Aden ought to be kept in a proper sanitary condition to avoid similar interruptions to commerce in future, or they should be removed.

43. *Vaccination.*—We have already given the total mortality from small-pox in India at 74,153 deaths in 1881. The details for each Government will be found in other Memoranda, and we shall merely introduce here a summary of results for all the provinces.

The vaccination establishment stood as follows:—

Sanitary Commissioners	8
Deputy Commissioners	14
Superintendents	41
Deputy Superintendents	81
Native Superintendents	143
Vaccinators (average)	3,445
Total vaccinations	4,571,166

44. *Military sanitary works.*—The expenditure on military works in Bengal Presidency in 1881 amounted to 626,242*l.* Extensive additions have been made to the accommodation of British and Native troops at Baxa, Lucknow, Quetta, Rawul Pindi, Jutogh and Murree.

At Allahabad the question of providing an improved water-supply, both for cantonments and for the fort, has been under discussion and inquiry.

At Lucknow an estimate of 1,654*l.* has been sanctioned for draining cantonments, and certain drainage improvements were carried out.

At Benares improvements have been made in the Sadr Bazaar.

At Delhi water has been led to the Infantry lines, Duryagunge.

At Naini Tal, drainage, water-supply, and protective works have been in progress, and the late landslips have been removed.

At Chakrata a design for an improved water-supply has been prepared.

The water-supply at Umballa has been in progress, and 8,459*l.* have been spent on it in the course of the year out of a total estimate of 69,936*l.* Distribution works have been completed, so that the actual supply was about 210,000 gallons per diem.

Peshawur.—Water-supply was still incomplete, partly on account of imperfections in the works, such as failure in the dam, sinking walls of settling tank, erosion of the duct from too great fall. Ought not such contingencies to have been foreseen and guarded against?

The water-supply at Cherat was nearly completed.

The drainage at Quetta was under improvement.

45. *Cantonments in Bengal Presidency.*—A summary is given of the condition of 68 cantonments, abstracted from sanitary sheets received from each.

The strengths of European and Native troops are given for each cantonment, together with admission and death rates, and sanitary notes, showing the prevailing diseases and local causes.

To any one acquainted with Indian sanitary problems these returns must convey a large amount of information on the conditions to which troops are exposed. Accounts from different stations, of course, vary, but in the great majority of cases there are ample disease causes to be grappled with. The underlying disease cause everywhere, nearly, appears to be marsh miasm, connected with low, unhealthy, damp sites for lines, want of suitable drainage, and in many cases, bad water. There is nothing new in the experience, which fully bears out what we have said on malaria and its diminution by subsoil drainage in our "Suggestions for the Sanitary Improvement of Indian Stations and their vicinity," 1882. We have nothing to add to the recommendations therein made.

46. *Civil sanitary works.*—Most of the information contained in this section has been already dealt with in other memoranda, and need not be repeated here, except to state generally that much useful work appears to be in hand all over India, and which, if persevered in and extended, will assist in improving the public health.

47. *General remarks.*—So far as concerns sanitary progress among the Indian people, perhaps the most important paragraph in the Report under review is that which refers to the introduction of local self-government and its relations to sanitary work. It has been long known that although great schemes of works must be carried out by the Central Governments in each Presidency, the chief disease and death causes to be dealt with were those connected with towns and villages, where the details were so multifarious as to be to a great extent beyond the reach of any central administration.

The work of decentralisation will be first tried in the Central Provinces, where the Act "proposes "the formation of local administrative areas by the aggregation of villages in circles and groups for "the purposes of local self-government. . . . By giving over these matters, which embrace the "whole range of sanitary works and improvements, to local management, there can be little doubt "that the residents who are primarily to be benefited by these improvements will take an interest in "them and bestir themselves regarding them in a way which they have never hitherto done." The experiment is a new one, and we must hope the best for it. The same principles it is intended shall be introduced all over India. In order to help with funds for sanitary work the local organisations will be relieved from police charges, "and all the advantages to be derived from the inspection and "supervision of the officers of Government will remain."

In the meantime it is satisfactory to learn that to a certain extent the proposed changes have been successfully initiated. The Commissioner of Burdwan states that in some parts of the Serampore division there are very large and populous villages, among the inhabitants of which are many gentlemen of high intelligence and business habits "who have undertaken the office of *punchayet* under the "village Chowkidari Act, and finding a very great demand and necessity for sanitary improvements "in their villages have availed themselves of the influence acquired by their appointment to induce "the villages to subscribe for such purposes. They have built culverts, made roads, and drained dirty "places, all with funds freely contributed by the villages," but there are refractory people in these villages as elsewhere, and what is wanted is to confer authority on the officers to carry out the will of

the majority, and this would involve the principle of local self-government which it is proposed to confer on the localities.

48. Dr. Cuningham's Report is concluded by a short discussion on the plague disease of Mesopotamia, which is stated by the resident physician at Baghdad to be a malignant contagious continued fever, attended with glandular swellings. Such at least is the account given by people on the spot, but Dr. Bowman says that there are, in his opinion no conclusive facts to show that the disease was of a contagious nature.

Its attacks were local, and took place in damp, undrained, insanitary localities. It had never appeared on board ship.

Reference is also made to the requirements of the International Sanitary Boards in compelling the Indian authorities to quarantine arrivals from the Dutch possessions on account of cholera there, under pain of quarantining Indian ports, at many of which there are usually a few cholera cases. It should be borne in mind in dealing with questions of this kind that, if such proceedings are in any sense necessary, the necessity should be proved by facts which have actually occurred at Suez. Opinions or inferences are of no use in a question involving such immense interests. Ships which have had deaths from cholera on board are on the facts in a bad sanitary condition just as if they were infected cellars in towns, and might be made liable to the operations of the sanitary officer, but this is all that is necessary. To quarantine healthy ships can be justified by no reasons of past utility.

49. Lastly. From the review we have given of this Report, it will be seen that it conveys information of great public importance. It shows that the large expenditure for sanitary works at Indian stations has been repaid by a large reduction in death-rates among European troops; that the losses from cholera have been greatly reduced in the absence of all quarantine procedure in India, as well as those from other preventible diseases. But that the fever death-rate continues, and is likely to continue so long as the Indian European Army is so largely composed of short service young men, who carry with them into Indian climates and stations a liability to fever which is incidental to young ages everywhere, but is fatally acted on in India. Nevertheless the facts also show that fever liability is connected with locality, and that steps should be persistently followed to reduce the fever death-rate to something like an equality among the stations.

The great local fever cause, as is shown by the sanitary sheets for cantonments, Native stations, and jails is want of drainage of subsoils, damp bad sites, and similar conditions leading to a large amount of inefficiency from malarial fevers everywhere, and it follows that the chief direction which future sanitary work should take is in endeavouring to eradicate such fever causes from the soil of India. We have pointed out the methods of doing this work in our "Suggestions" already referred to.

Similar works are required for improving areas occupied by Native populations, as is shown by the enormous losses from fevers in all Indian Governments. As regards other disease causes in towns and villages, it is to be hoped that these may be dealt with by the new local authorities, and on the principles stated in our "Suggestions" of 1882. And we would call attention to the Aden coincidence as showing the necessity of careful attention to the sanitary condition of all Indian seaports, which is the only method to show that the infliction of quarantine on commerce is unnecessary.

It seems not unlikely, from facts stated in the present Report, that some at least of the high death-rates in Indian jails may be due to absence of suitable precautions in following outdoor work. This subject might possibly be considered by the Commission appointed on jails.

In conclusion, our acknowledgments are due to the Sanitary Commissioner with the Government of India, for the large amount of very useful and important information which he has been able to include in this admirable Report.

2nd July 1883.

No. 2.

MEMORANDUM of the ARMY SANITARY COMMISSION on the REPORT of the SANITARY COMMISSIONER for MADRAS for 1881.

1. The population of Madras Presidency on which the vital statistics of 1881 were calculated was that of the same year's census of districts and towns, which gave a total population of both sexes of 28,676,375. But there appear to be groups of population not as yet furnishing returns included in the official census of the whole Presidency, which was as follows:—

Males	15,242,122
Females	15,597,059
Total	30,839,181

Apparently the population used in the returns may be considered as nearly equally divided between males and females, but showing a slight preponderance on the side of males, as follows:—

Males	14,389,093
Females	14,287,282
Total	28,676,375

2. The year's births among this population were of—

Males	-	375,816 = 13·1	per 1,000.
Females	-	356,050 = 12·4	,,
Total	-	731,866 = 25·5	

This birth-rate is the highest yet registered, and its relation to the rate of the famine period of 1877 is clearly shown by the following annual ratios:—

Years.	Births per 1,000 of Population.
1875	21·1
1876	21·6
1877	16·3
1878	21·9
1879	16·4
1880	22·9
1881	25·5

These figures, of course, include registration defects, and perhaps to a greater extent during 1877–78 than in the other years, but it is satisfactory to see that births are increasing, and that the registration of them is improving.

3. Deaths registered in 1881 were of—

Males	-	239,494 = 8·3	per 1,000.
Females	-	226,188 = 7·9	,,
Total	-	465,682 = 16·2	

These ratios are much below the truth, and it appears as if the reduction of mortality after the famine period had been attended by falling off in the registration. This is shown by the following death-rates passing through the famine time:—

Years.	Death Ratios per 1,000 of Population.
1875	21·1
1876	23·3
1877	53·2
1878	27·8
1879	18·9
1880	15·7
1881	16·2

Birth and death ratios differ considerably in different districts, probably due to the state of the registration in each. In Madras itself, where the registration is under municipal management, the facts of the year were perhaps more correctly arrived at, and the ratios per 1,000 of population in 1881 were of births 40·6, and of deaths 38·3, but even these rates bear marks of being approximations only.

4. The number of deaths entered under the customary heads were as follows:—

Diseases.	Deaths.	Deaths per 1,000 of Population.
Cholera	9,446	0·3
Small-pox	15,776	0·5
Fevers	203,542	7·1
Bowel complaints	18,961	0·6
Injuries	11,527	0·4
Other causes	206,480	7·2
All causes	465,682	16·2

This death-rate of 16·2 per 1,000 compares favourably with the previous five year's average rate, 21·2 per 1,000, which, however, included the famine and scarcity years, but the facts, as a whole, tell against the registration accuracy.

5. We shall next discuss the facts of disease history under each of these heads, beginning with cholera, and the relation of the epidemic of 1881 to past cholera history as given by the Sanitary Commissioner in the present Report as follows:—

Years.	Deaths from Cholera.	Years.	Deaths from Cholera.
1866	200,961	1874	313
1867	33,205	1875	94,546
1868	8,036	1876	148,193
1869	21,034	1877	357,439
1870	55,647	1878	47,163
1871	17,655	1879	13,296
1872	53,247	1880	613
1873	849	1881	9,446

This abstract affords unmistakeable evidence of the essentially epidemic character of Madras cholera. Every year during the 16 years it has been present in some district of the Presidency. The cholera deaths registered in 1866 appear to have been those of a period of decline in a great epidemic, followed by another outburst between the years 1869 and 1872. Then came two years of comparative quiescence, followed by the great epidemic of the famine period, and it appears as if 1881 showed the beginning of another such epidemic time. It is necessary to call attention to this history, because there has been a disposition on the part of certain civilian officers to attribute the cholera of 1881 to a pilgrimage from which it is supposed, as a matter of opinion, to have been carried over Madras Presidency by returning pilgrims. The preceding abstract will be sufficient to enable any one to form an opinion on the probable influence of the pilgrim element; or, indeed, of any single known predisposing cause of cholera on the facts of the case. The point which concerns sanitary administration is whether there are any known methods of reducing the high predisposition to cholera attacks among the civil population, which these statistics show to be present, and which cannot be accounted for on any supposed transfer of the disease by pilgrims.

6. The next abstract shows the monthly prevalence of cholera mortality for the whole Presidency in 1881.

Months.	Cholera Deaths.	Months.	Cholera Deaths.
January - -	51	July - -	16
February - -	4	August - -	1
March - -	12	September - -	4
April - -	92	October - -	297
May - -	92	November - -	1,333
June - - -	151	December - -	7,403

We have here evidence of two distinct epidemic outbreaks, the first ending in August with a single death. From this first outbreak there were 419 deaths, but the January deaths, 51 in number, were in reality, part of an irregular epidemic of the preceding year, during which there were three deaths in October, nine in November, and 219 in December. The same outbreak passed over to January 1881, and caused 51 deaths, as the table shows. The epidemic of 1880, and 406 deaths of the epidemic of 1881, all took place in the far north-eastern districts of Madras Presidency, which bound with the endemic area of Bengal. It is not of course alleged that this earlier outbreak was caused by the Tirupati festival, which took place early in October. It is fully admitted that cholera was moving slowly to the south from the Godavari region before the festival; all that is meant is, that such being the fact Tirupati festival was held and cholera appeared in a few cases among people who had been there, and, as the table shows a great outburst of the disease on and after October, it may be presumed that the spread of pilgrims from Tirupati was the cause of the great increase of cholera.

The facts in the preceding abstract appear, however, to show that, whatever may have been the influence of the pilgrim element, there was a real epidemic, obeying the usual epidemic law of increase, which would apparently pass over to the month of January 1882 to complete its period in that year.

7. We shall discuss the Tirupati case on other papers, but in the mean time we must ask the question, why there was cholera at this fair.

There are two Tirupatis, a lower and an upper. The lower town was carefully inspected by Dr. Price, Deputy Sanitary Commissioner, on 8th October, six days after the first case of cholera had taken place. It appears to have been in a fair sanitary condition. It was not there, however, but in upper Tirupati, that the disease broke out, and this is the place of pilgrimage into which the Sanitary Commissioner could not enter; he had therefore to content him such evidence as was at hand, and this is stated as follows:—"The hospital assistant seemed to me a most intelligent straight-"forward man; he was quite certain that no one ill of cholera went up the hill. The accommodation "on the top of the hill was insufficient and bad; the water, drawn from a sacred tank, used both for "drinking and bathing, he described as being very bad."

Surgeon-General Dr. Cornish reports, "The general sanitary condition of upper Tirupati in regard "to water-supply and conservancy and arrangements for the distribution of food appear to be very "defective."

The sacred food "prasadam" was found on examination to be disgusting, "utterly unfit for human "food, and likely to produce sickness if used as such."

These facts appear to be related to each other in the following order. The town of Tirupati itself in North Arcot had no cholera. No cholera case entered upper Tirupati, where the festival was held. This locality was in a very bad sanitary condition, but it lay beyond and out of the jurisdiction of sanitary officers. Out of 21 districts in Madras Presidency, cholera had appeared in six up to September, and North Arcot was not one of these. The deaths up to September had been 423 in number, the last four of which took place in Tanjore district in September. Here the first outbreak appears to have ended. But in October, 13 districts were attacked and yielded 297 deaths. These districts were scattered all over Madras, from Ganjam in the far north-east to Malabar on the far south-west, and from Bellary on the north to Tanjore on the south-east. As we have seen, the first case of this outburst took place on 2nd October. There was no communication of the disease to the town, and yet it is assumed that this wide distribution of cholera within the month was due to

pilgrims. But there can be no difficulty in accepting the following view of the matter given by the Surgeon-General, who says, "the epidemic visitation had been long foreseen, and authorities were "duly warned of its probable advent. The insanitary conditions abounding at upper Tirupati, no "doubt, had the effect of lighting up the disease at least there, but there is want of sufficient evidence to show that "the dispersion of the pilgrims apparently helped its spread southwards," that is so far as being the means of conveying infection; otherwise, it is not unlikely that crowding of pilgrims into villages and towns may have acted as an added insanitary condition during the progress of a great epidemic outbreak, which covered more or less 18 out of 21 districts, and 109 registration circles out of 227. The deaths, however were due to a small number only of population groups, for all the cholera deaths of 1881, which amounted to 9,446, were returned, from 1,505 groups out of 47,325 in the Presidency. The facts as a whole scarcely ally themselves with the single Tirupati death, except in so far as this single death was apparently the first recorded death of the second epidemic of 1881. On one point, however, there appears to be no doubt, namely, that if this festival is allowed in future to be repeated, it ought to be on condition that the place should be thrown open like other festival sites to the sanitary officer and his work.

8. There are 72 towns in Madras Presidency, with a population of 1,498,299. Cholera deaths were registered in 36 of these, and were 2,220 in number. Ten of the affected towns had only one death each, but several of them suffered severely. Trichinopoly had a cholera death-rate of 9 per 1,000, Palni of 10·9 per 1,000, Arcot of 11·4, and Tenkasi of 12·2 per 1000. Taken over the whole town population, the cholera death-rate was 1·4 per 1,000. The district rate on a country population of 27,178,076 was 0·2 per 1,000, or just one-seventh part of the town death-rate. One may well ask what the municipalities are doing.

9. There is only one special report on this matter, that from Salem, which in past epidemic seasons had sustained great losses from cholera. In 1881, out of a population of 50,713, there were 444 cholera cases, of which 130, or 2·5 per 1,000 of the population, proved fatal.

There are 5,312 villages in Salem district, of which 86 yielded 540 deaths from cholera, a death-rate of 0·2 per 1,000 against a previous five years average of 2·2 per 1,000. The death-rate in Salem town thus exceeded slightly the district rate of previous years, while it was above tenfold the rate of 1881. The first case in Salem town was in a policeman who had been in Salem for two months, and consequently had not been at Tirupati. He was attacked at drill on 11th October, and died the same night.

On the 7th October, a case of diarrhœa took place at Suramangalam station; it was treated on the spot, and went on by rail a few hours later. There is hence not an atom of evidence to show that Salem cholera was imported. The town in past times has suffered so much from cholera that the disease had come to be considered as endemic. During the epidemic of 1875, there were 840 cholera deaths. Of late years many important improvements in conservancy have been introduced, and the use of foul river water for culinary purposes has been forbidden. As soon as the first cholera case showed itself, the town was thoroughly cleansed and limewashed, and no doubt the lower death-rate of 1881 epidemic was partly due to active sanitary work.

The drainage has still to be undertaken, and a good water-supply has still to be provided. These two improvements must go hand in hand, and be completed before the town is comparatively safe, even, from cholera. But according to certain importation views stated in the Report, the cheapest reform would simply be to forbid the Tirupati festival in future, only we should strongly recommend the complete sanitary reformation of the town at the same time, or the authorities will very certainly have to account with cholera when it next becomes epidemic.

We shall revert to these local disease causes in a subsequent part of this Memorandum.

10. *Small-pox.*—During the last three years in the returns there has been a large reduction in the mortality from small-pox in Madras Presidency, and perhaps the best way to show this fact will be to give the deaths for the previous 11 years, as follows:—

Years.	Small-pox.	
	Total Deaths.	Deaths per 1,000 of Population.
1871	20,823	0·8
1872	39,074	1·2
1873	51,782	1·7
1874	43,343	1·5
1875	24,775	0·8
1876	23,469	0·8
1877	31,321	1·0
1878	56,360	1·9
1879	17,840	0·6
1880	14,529	0·5
1881	15,776	0·5

In 1881, small-pox deaths were returned from 199 out of 227 registration circles, but the proportion of attacked villages is not given.

The monthly prevalence of the disease in 1881 is shown by the following deaths:—

Months.	Small-pox Deaths.	Months.	Small-pox Deaths.
January	1,570	July	1,078
February	1,539	August	1,056
March	2,202	September	975
April	1,709	October	927
May	1,271	November	1,098
June	1,112	December	1,239

Of these small-pox deaths, 1,047 took place in 49 towns out of 72 in the returns. The town death-rate was 0·7 per 1,000. In the country districts there were 14,729 deaths, equal to a small-pox death-rate of 0·5 per 1,000. The town of Madras yielded the highest small-pox rate of the year, namely, 4·1 per 1,000.

11. The successful vaccinations were 538,152, and successful re-vaccinations numbered 6,858 out of 10,541 operations of this class. The ratio of vaccinations is very small when compared with the population and birth ratios. These vary of course according to the accuracy of the registration in each district and the local activity of the service. Perhaps the best way of judging of the amount of work done will be simply to state the figures:—

Population	28,676,375
Births, 1881	731,866
Successful vaccinations	538,152

But the vaccinations refer of course to the whole population and not specially to the births.

The Sanitary Commissioner is quite aware that the results are unsatisfactory. He calls them "poor and miserable."

The vaccination establishment of the year stood as follows:—

Inspector of vaccination and Deputy Sanitary Commissioner	1
Deputy Inspectors, 1st class	30
" " 2nd class	9
Vaccinators, 1st class	236
" 2nd class	387
Probationers	104
Peons	33

The cost of each successful vaccination case was annas 4·9.

The chief improvement required in this branch of the sanitary service appears to be in the direction of greater extension among infants, for out of the total births stated above only 75,710 were vaccinated under one year of age, or 11·1 per cent. of the births, and out of 15,776 deaths from small-pox 3,357 took place under one year of age, 7,845 above one year and under 12 years of age, and 4,574 above 12.

12. *Fevers.*—As has been already shown, no fewer than 203,542 deaths were returned as due to fevers out of a total of 465,682 deaths. Any discussion in regard to fever etiology and history in Madras is hampered by a knowledge of the fact that fever diagnosis is very uncertain all over India. Nothing more can be done at present than merely to register the facts and see what may fairly be deduced from them. On this subject the Sanitary Commissioner has given a table showing the fever mortality in each of the districts of Madras Presidency for a period of 16 years, of which the following is an abstract:—

Years.	Fever Deaths.	Years.	Fever Deaths.
1866	110,102	1874	226,220
1867	112,511	1875	252,042
1868	106,692	1876	230,032
1869	132,346	1877	469,241
1870	151,027	1878	374,443
1871	192,469	1879	285,477
1872	214,148	1880	289,940
1873	222,843	1881	203,542

The sum of these columns of eight years in each gives, for the years up to 1873, 1,241,138 fever deaths, and for the subsequent eight years 2,250,997 deaths, not far from double the fever mortality, but the years 1877 and 1878 were the famine and scarcity years, and as such were exceptional, yet even if allowance be made for this circumstance we shall still have a very large augmentation of fever and its mortality to account for.

In 1881 every registration circle returned fever deaths, and no doubt every one of the villages, although the fact is not stated.

15. Taken by months the deaths were registered in the following numbers, and the average monthly rainfall at 233 observing stations is also given :—

Months.	Fever Deaths.	Rainfall, Inches.
January	21,768	0·40
February	19,744	0·01
March	17,420	0·81
April	15,572	0·34
May	16,081	2·27
June	14,507	4·29
July	16,155	3·09
August	15,370	7·63
September	15,228	6·00
October	15,881	2·71
November	17,129	6·57
December	18,867	2·62

The average fever death-rate was 7·1 per 1,000, which was less than the previous five years' rate. This was 9·2 per 1,000, but it included the famine period.

14. When taken by districts fever death-rates show unexplained peculiarities which deserve notice. For example, the fever death-rate in Tinnevelly was only 4·4 per 1,000, while the previous five years' average was 5·1 per 1,000. The fever death-rate in Tanjore district was no more than 2·3 per 1,000 against a previous five years' ratio of 2·6 per 1,000. There are several districts in which the rates are somewhat higher, but more or less persistent, and then we have the following districts in which the rates are much higher:—

District.	Fever Deaths per 1,000, 1881.	Fever Deaths per 1,000, 5 years Average.
Nilgiris	10·6	12·1
Cuddapah	11·4	20
Vizagapatam	12·0	11
Ganjam	12·6	11·7
Kurnoul	16·2	22·3

The facts appear to show that there are certain districts in which the fever death-rates are persistently low, while in others they are persistently high, although variable in both cases.

Fever death-rates in towns vary as much as they do in country districts. The low average in Tinnevelly district extends also to the towns in it, in six of which it is under one per 1,000. There are very few towns in which the fever-rate exceeds 10 per 1,000, and the average rate for all towns is 6·4 per 1,000, while for country districts, as already stated, it was 7·1 per 1,000.

15. The facts taken as a whole point to the influence of local causes. But we may place side by side the monthly fever deaths and monthly rainfall in districts of highest and lowest mortality for purposes of comparison as follows :—

Months.	Kurnoul.		Tinnevelly.		Tanjore.	
	Rain, Inches.	Fever Deaths.	Rain, Inches.	Fever Deaths.	Rain, Inches.	Fever Deaths.
January	—	1,759	1·04	1,192	3·04	384
February	—	1,516	0·02	793	0·02	409
March	0·74	1,658	2·40	687	0·07	311
April	0·29	1,254	0·41	590	...	365
May	1·46	1,480	1·07	490	0·40	414
June	4·38	1,126	9·13	483	1·16	417
July	0·90	1,160	3·32	534	6·22	384
August	5·54	932	6·89	514	4·07	345
September	4·78	923	9·83	474	5·85	389
October	1·86	942	3·45	507	2·34	475
November	1·82	969	9·07	523	6·88	480
December	—	1,236	3·42	737	12·10	427
Total	21·75	Ratio per 1,000 16·2.	23·09	Ratio per 1,000 4·4	41·16	Ratio per 1,000 2·3.

The average rainfall of 233 observing stations for eight years was 46·95 inches, while in 1881 the fall was 36·74 inches, or above 10 inches under the average. For the whole of Madras Presidency this reduction in rainfall was attended, as has been shown, by a reduction of 2·1 per 1,000 in the fever death-rate.

In Kurnoul, the average eight years' rainfall had been 30·72 inches, and in 1881 it fell to 21·75 inches. The average five year's fever death-rate in this district had been 22·3, and it fell in 1881 to 16·2 per 1,000.

In Tinnevelly district the eight years' average rainfall had been 26·08 inches, and in 1881 it was 23·00 inches. The five years' average fever mortality had been 5·1 per 1,000, and in 1881 it was 4·4 per 1,000.

In Tanjore the eight years' average rainfall had been 43·32 inches, and in 1881 it was 41·16 inches. In this district the five years' average fever death-rate, which had been 2·6 per 1,000, fell with the lower rainfall in 1881 to 2·3 per 1,000.

These examples will be sufficient to show the influence of rainfall on fever mortality. There is only one element in the tables which appears to have influenced the amount of fever, and this is the relative quantity of rain; but there is no sufficient proof that the rain distribution of the year exercised any decided influence on the monthly death-rates in any of the examples.

16. Among general fever causes in Madras Presidency must be placed the prices of food, but these could scarcely have influenced the general fever-rate of 1881, for the Sanitary Commissioner says, "It is gratifying to be able to record that the prices of food during 1881 in every one of the 21 "districts are not only less than the average of the eight years taken before the famine, but even better "than 1880."

The experience of the famine years has shown how fatal is the result of drought and food scarcity, followed by heavy rainfall, on the mortality from fever. These fever causes were absent in 1881, and the fever death-rate may hence be taken as showing the influence of ordinary every-day conditions existing among the population. Viewed in this light the statistics of fever already given show that without any other causes than those usually operating the fever mortality has been steadily rising, and it is with this element that the sanitary service must at present occupy itself.

17. Some years ago we suggested the possibility of facts of this class being connected with a cyclical law of malarial fevers. In subsequent reports received from India, this view was not sustained. Dr. Cornish, who was Sanitary Commissioner of Madras, considered that the facts might be explained by the existence of waves of malaria passing over the country; but the present Sanitary Commissioner, Dr. Furnell, does not adopt this view, while admitting, nevertheless, the gradual increase of fever mortality, which he appears inclined to attribute to atmospheric conditions. Unfortunately, the only meteorological element in the report is rainfall, the influence of which is amply illustrated by diagrams, but this, as we have seen, affords us no help in accounting for the facts. Dr. Furnell says that his own impression is, "that vicissitudes of temperature, which after all are "comparative, have much to do with the production of intermittent fever. The natives of this "country in their thin cotton garments, are exposed to rapid alterations of temperature, especially "during monsoon months, and anyone who has had much experience in this country, especially as a "medical man, must remember numberless instances where changes of temperature have been amply "sufficient to induce ague. The most acute case of ague I ever saw was brought on in a young "European officer, in previously robust health, from sitting a long time during the prevalence of "the hot winds behind a well-watered kuskus tattie." (It can scarcely be said that this was a case produced solely by variable temperature.) Dr. Furnell continues as follows:—"I well remember that "when Lord Napier first came to the Nilgiri hills, it was almost impossible to carry on the domestic "duties of Government House, because all the Native servants were down with fever. The then "residence of the Governor, Fern Hills, was thought to be malarious, but when flannel socks, shoes, "more warm clothing, and charpoys to sleep on had been served out to the people the malaria "disappeared."

The Sanitary Commissioner does not consider, however, that absence of these necessaries of clothing is a direct cause of ague. The facts he cites have been long known, but they only amount to this, namely, that among people living in a country where diseases known as "malarial" fevers prevail, predisposition to attacks may be increased or lessened by neglect or observance of certain conditions not directly connected with the fever cause. No doubt there would be less fever if the whole Madras population was suitably lodged, clothed, and fed. But experience in other districts of India has shown that where malarial fever prevails with a certain degree of intensity it spares neither rich nor poor. Improved social conditions can alone supply the wants which Dr. Furnell has dealt with, and climate cannot be altered. We are thus shut up to dealing with local malarial causes in and around dwellings and the practical result of this discussion is, that the sanitary service and executive officers generally can only hope to arrest the increasing fever mortality by dealing with this aspect of the case.

So far as regards the fatality of ague, Dr. Furnell remarks that "this fever, as is well known, is not "ordinarily, and need not be, fatal or even dangerous." And he attributes the great mortality from it to want of proper treatment, arising partly from insufficient medical attendance, but chiefly from Native superstitions in attributing fever to an infliction of their gods and goddesses which ought to be borne with and not resisted.

On the whole, therefore, the history of these fevers comes out tolerably clear in the present report, as well as the remedies, administrative and social, which have to be applied for reducing their amount and fatality.

18. *Bowel complaints.*—We have already shown that in 1881 there were two distinct epidemics of cholera, and by giving the monthly deaths from bowel complaints in the usual manner it will be seen that the two diseases had not the same statistical history.

There are 227 circles of registration, in 109 of which cholera showed its presence in some part of the year, while bowel complaint deaths were returned from 222 circles. This fact may show better registration, but when taken in connexion with the following monthly deaths, it shows that the two diseases did not prevail under the same law. The epidemic nature of cholera has been shown in a preceding table, but it will be seen that deaths from bowel complaints were more equally distributed throughout the year.

Months.	Deaths from Bowel Complaints.	Months.	Deaths from Bowel Complaints.
January	1,926	July	1,682
February	1,520	August	1,687
March	1,445	September	1,582
April	1,241	October	1,717
May	1,299	November	1,592
June	1,329	December	1,843

The total registered deaths were 18,961, equal to a death-rate of 0·6 per 1,000, against a previous five-years' rate of 1·1 per 1,000. Of the registered bowel complaint deaths 3,174 were returned from among 1,498,299 town inhabitants, a ratio of 2·1 per 1,000. There is no statement in the report on the probable causes of these diseases.

12. *Injuries.*—Deaths so registered are classed as follows for 1881:—

Suicides	1,603
Wounding	977
Accidents	6,555
Snake-bite and wild beasts	2,392
Total	11,527

Deaths from *injuries* exceeded the deaths from cholera by 2,081.

It seems unnecessary to discuss the disease history of the year at greater length, but we cannot conclude these remarks without stating that no more than 259,252 deaths have been included under it, and that we have absolutely no information as to the probable causes of 296,430 deaths, a number exceeding the whole mortality from fevers.

13. *Health of troops.*—The subject is connected in the present report with the condition of stations and sanitary works. We shall deal with the subject on other papers, and all we propose to do is to give the year's statistical data.

British Troops.—The strength of British troops for the year appears to have averaged 10,435. The admissions to hospital were in the ratio of 1,164·8 per 1,000, the daily sick averaged 68·2 per 1,000, and the total deaths 11·1 per 1,000. The chief admission causes were fevers, classed as follows:—

Fevers.	Admitted.	Died.
Typhoid	9	5
Continued	720	1
Remittent	51	1
Intermittent	2,100	—
Total	2,880	7

The fever death-rate of 1881 is the smallest on record, and may be compared with the numbers of fever deaths in the previous five years, which stood as follows:—

Years.	Fever Deaths.
1876	26
1877	24
1878	26
1879	24
1880	16
1881	7

There has been a great reduction in the deaths classed under the head of "typhoid fever." The preceding 13 years' average yielded 37 deaths per annum, and as we have seen only five deaths were so recorded in 1881. This reduction is not due to transference of typhoid fever cases under other heads. It arises from an absolute reduction, not only in fever cases, but in fever mortality. Enteric fever still caused five sevenths of the deaths, but as we have seen there were only seven fever deaths in all. A great increase of fever in the Madras European army took place in 1878, the year after the famine, and the subsequent fever history may be shown as follows. The numbers give the fever admissions for each year.

Fever Types.	Years.			
	1878.	1879.	1880.	1881.
Intermittent	1,593	2,617	3,396	2,100
Remittent	330	190	160	51
Continued	1,940	1,357	1,036	720
Enteric	7	12	25	9
Total	3,730	4,176	4,617	2,880

The facts bear out the view of the late Surgeon-General of Madras that of late years there had been an epidemic increase of fever in the army. But the question of classification appears still to be unsettled, for the Sanitary Commissioner states in the present report that "on reading over an "abstract of cases, it is very evident that the entry to typhoid fever is only made when a case of "continued fever assumes grave symptoms," and he recalls the fact he had formerly stated that fatal cases were entered as remittent fever, which after death had presented the usual pathological appearances of typhoid.

It appears, however, as if the fever history of 1881 had, to some extent, settled the controversy, because it has distinctly shown that the typhoid fever death-rate of the year is an independent factor in the history. But this conclusion leaves the question of diagnosis and its difficulties, whether at the beginning or end of the case, just where it was. Everything must necessarily depend on the diagnostic skill of the medical officer, and if he fails, it by no means follows that the disease does not exist.

The most satisfactory result of the discussion, however, is that 1881 has shown a large reduction of fever and fever mortality in the Madras army.

Cholera.—In 1880 there was only one case of cholera which proved fatal in the Madras army, while in 1881 there were 35 cases and 17 deaths. All the cases took place at two stations in Madras command and one in Burma. The numbers were as follows:—

Kamptee	25 cases.
Secunderabad	3 "
Thyet Myo	7 "

Small-pox yielded eight cases, one of which proved fatal, all at Bangalore.

Hepatic diseases gave rise to 403 admissions and 16 deaths.

No account is given of the conditions under which these diseases took place.

There were 2,247 admissions from venereal diseases, of which 905 were for primary syphilis; 237 for secondary syphilis, and 1,105 for gonorrheal affections. There were beside ten cases contracted on the march. It is not necessary to discuss this subject further at present.

20. *Native army.*—This army numbered 30,315 men on 1st January 1882, but only 23,314 of these supplied returns.

The disease and death-rates among these men for 1881 were as follows:—

Admissions per 1,000	948·7
Daily sick	44·6
Deaths in and out of hospital	16·2
Invaliding	4·70

The admissions to hospital were 22,119, of which 8,673 were for intermittent fevers, yielding 38 deaths. There were 75 admissions, and 31 deaths from cholera. Of these, 24 admissions and six deaths were at Kamptee. Including British troops, Kamptee yielded 49 cholera cases, but the epidemic was more severe at Trichinopoly, where 39 native soldiers were attacked, of whom 18 died.

Small-pox yielded 33 admissions and three deaths among native troops. The year 1881, taken as a whole, was favourable to the health of both armies, but there were certain of the stations where they suffered so much as to show necessity for inquiry and improvement.

21. *Sanitary work at stations, towns, and rural circles.*—There is a large amount of detail on these subjects in Dr. Furnell's Report, chiefly derived from stational and municipal returns, and perhaps the best way of dealing with the subject will be to select the leading stations and population groups, and give the year's results as briefly as possible:—

Bangalore station. *British troops.*

Strength	1,389
Admissions per 1,000	1,180·7
Daily sick "	74·1
Deaths "	5·0

Drainage.—13,463 feet of drains constructed. Water-supply from Ulsoor tank principally, which receives the surface drainage of the station. "This is very objectionable." Of course it is, and it has been declared to be so for about a quarter of a century. The conservancy is done by the municipality on the dry-earth system, and the general sanitary condition was "good." The rainfall was 27·4 inches, against 51·49 inches in 1880; in which year all the disease rates were higher, but the drier year had more small-pox. New wells were dug, and 1,360 feet of roads were opened in the most crowded parts of the native town, admitting of improved drainage, ventilation, and conservancy. The town and station appear to be under the same committee.

Bellary station.

Strength	445
Admissions per 1,000	2,170·8
Daily sick "	112·3
Deaths "	8·9

Current sanitary work carried out; surface drainage requires improvement. The very high admission-rate included 1,174·4 per 1,000 from fevers, and 470·2 per 1,000 from venereal diseases. There was no cholera among British troops. But Bellary town yielded 116 deaths from cholera, 56 from small-pox, and 441 from fever. Its population is 51,766. It had a five years' death-rate of 34 per 1,000, and in 1881 its rate was 18·7 per 1,000. The drainage is described as follows:—"Un-"satisfactory both in streets and houses. Open shallow drains exist in the streets, and in the houses

there are cesspools." Otherwise the conservancy appears to be attended to, and 2,474*l.* were sanctioned for it. The cholera deaths are attributed to importation from Tirupati fair, without the slightest evidence, and in the face of this state of domestic drainage. The rainfall in 1880 was 16·2 inches, or 5·4 inches below the previous year's fall.

There are three circles in the Bellary district in which the drainage is passed into cesspits, and so into the earth. Their conjoint population is 1,781,869, and 884*l.* was allotted for conservancy, all of which was not spent. The water-supply is of the usual Indian character, and much of it not to be depended on.

Secunderabad Station.—

Strength - - - - -	2,407
Admissions per 1,000 - - -	787·1
Daily sick - - - - -	24·0
Deaths - - - - -	15·2

Of the admission-rate 126·3 was due to fevers, and 306·2 to venereal diseases. Of the deaths among native troops seven were from fever, three from cholera, eight from dysentery, and one from diarrhœa.

The drainage of this important station is reported as much improved since last report, and a complete system was in progress of being carried out. Good water was scarce. European troops were supplied from wells. Cantonments and bazaars kept fairly clean, but the sewage is buried "almost in the bed of the dhobie's tank, to be ultimately washed into the Hussain Sagar tank." Courtyards of regimental lines require attention. Tirupati fair was held early in October, and has been made the scapegoat in many ill-kept places for imported cholera. In Secunderabad cholera appeared "towards the middle of the year." It "cannot be charged on this fair, but is reported as "having been imported."

Three non-fatal cases took place among European troops, and three deaths among Native troops. It prevailed in Hyderabad in August to November and caused 16 deaths.

The cholera among troops at Kamptee has been already referred to. This station, although in Madras command, is situated in the Central Provinces, about 10 miles from Nagpur. The average strength of European troops was 903. The admission-rate was 1,402 per 1,000, of which 612·4 per 1,000 was due to fevers, and the death-rate was 26·58 per 1,000. Of the deaths, 24 in number, 14 were due to cholera. The town of Kamptee has a population of 48,831, and is situated in a region where cholera prevailed as an epidemic in 1881. It broke out in the circle in July and lasted till October, and occasioned 116 deaths, equal to a death-rate of 1·7 per 1,000 from cholera. The disease appeared in July among the Native troops, 1,146 in number, and ceased in October, having in the period given rise to 24 attacks and 14 deaths. The first case among British troops took place in August, this case was followed by 22 in September, and 2 in October, 25 in all, and there were among European troops also 14 deaths. The death-rate among European troops was 15·5 per 1,000, among native troops 12·2 per 1,000, and in both conjoined 13·6 per 1,000. It appears to us that some account ought to have been given of the reason why troops, living under presumably better sanitary conditions than the native population, should have suffered an eightfold mortality? Under this head there is very scant information. As a rule, drainage is said to be "satisfactory" by natural nullahs, but, "on the occasion of heavy rains, portions of the cantonment get inundated owing to the "bridges on some of the nullahs being too small. This is an evil remediable, but very expensive." Now, in 1881, the rainfall was 71 inches against an average fall of 52 inches. The site itself is on low ground, and it is highly probable that there was inundation, and, if so, it is very likely that some of the wells supplying water for troops may have suffered. The usual conservancy operations appear to have been carried out. Any way this is one of the cases demanding very careful investigation and application of remedies. At the other less populous stations the usual sanitary work appears to have been more or less carried out, and there is nothing in the abstracts specially calling for notice.

22. *Municipal Towns.*—There are 47 of these which make returns of work and expenditure. Their population in 1881 was 1,216,198. Their total estimated income for 1881–82, was 147,234*l.*, of which 31 per cent. was allotted for sanitary purposes. The total amount expended in the period by 45 towns making returns was 24,444*l.* for conservancy; for water-supply improvements in 39 towns making returns the expenditure was 1,926*l.*, and 16 towns reported the expenditure of 3,206*l.* for town improvements. As in previous years, the amount allotted for sanitary work, namely 45,676*l.*, exceeded the expenditure, which in 1881 was represented by a sum of 33,470*l.* Under the year's expenditure was included 243*l.* for sanitary measures at fairs and festivals, 1,750*l.* for markets and slaughtering-places, and 3,648*l.* for latrines, dust-bins, &c. It is satisfactory to see that the expenditure details bear a certain resemblance to those at home, but the amounts appear to be wofully deficient when we take the local necessities into consideration. It is, of course, impossible to form a judgment as to the efficiency of the work done, unless we accept the death-rates as evidence, and, according to the tables, these rates, which on a previous five years' average yielded 26·6 per 1,000 for all the towns, had fallen in 1881 to 22·8 per 1,000, but apparently both ratios are too low. Of the figure reduction there can, however, be no doubt. Under this head we may again cite the case of Guntúr, which has for a number of years been under active municipal improvement. Its five years' average death-rate has been 20 per 1,000, and in 1881, it was only 12·7 per 1000. It had not a single death from cholera or small-pox, and its fever death-rate was only 2·5 per 1,000. In this case, effectual work was done, and it is probable that the municipal authority had sent in accurate returns. Sanitary work has also been extended beyond the town, for in Guntúr circle "fifty towns and villages "enjoy the privilege of having conservancy establishments, who keep the streets, &c. clean. The "sweepings from these are collected and sold by auction."

The town of Salem, already referred to, has undergone some improvement of recent years. The use of river water for drinking and culinary purposes has been put an end to, with apparent advantage during the late cholera. The town is kept clean by an establishment of sweepers. Public latrines, 58 in number, have been provided; new wells and water sources have been opened, but the drainage passes by flat, unpaved, open cuts "to catchpits or cisterns on the river banks, the contents of which are removed by handpumps and carried away in barrels." It is, of course, perfectly right that, in the present state of drainage and water supply, the cleansing should be actively and unceasingly supervised, but the arrangements can scarcely be considered as sufficient for a town of 50,000 people.

Trichinopoly.—This town, with 75,306 inhabitants, had 678 cholera deaths. It is undrained, and sewage is passed into house cesspits. In certain parts of it intermittent fevers prevail. The town has been surveyed for drainage, "but the cost is so great (amount not stated) that the Commissioners "cannot see their way to its completion." Unfortunately, cholera takes no cognizance of the cost, and raises its own inevitable tax.

23. *Local Fund Circles.*—Returns were received from 31 circles, containing the rural population of the Presidency. In small country population groups most of the required sanitary work, namely, cleansing, and protection of water sources, should be done by the people, but there are cases where work of this kind has to be paid for, and the following abstract will give a general idea of its nature and extent.

Nature of Improvements.	Amount sanctioned.	Amount spent.
	£	£
Conservancy - - -	17,410	11,184
Improvement of village sites -	4,264	551
Water supply and repairing Construction, &c. of tanks and wells	10,849	5,124
Latrines, dust-bins, &c. - -	4,990	2,815
Markets, &c. - - -	9,449	3,411

The population of these local fund circles in 1881 was 28,617,226. Their total available income (one third land cess) was 135,139*l.*; of this amount 28·7 per cent. was allotted for sanitary purposes, and excluding the amount spent on markets, the sum available for real sanitary work among all these millions of people was no more than 38,695*l.*, of which only 20,154*l.* was spent, and the chief items are given above. We wish that the fall in death-rates in these rural circles from a five years' average of 21·1 per 1,000 to 15·8 per 1,000 could be accepted as proof of better health following on real work done, but with the facts given in the tables, showing the amount of epidemic disease included in the death-rates, this view can scarcely be accepted, for it is highly probable that with better registration the death-rates would rise.

The summary of expenditure given above sufficiently indicates the class of improvements for these local fund circles, but a few particulars may be added to show the extent of work required.

Water-supply.—The principal sources of water-supply are tanks, wells, rivers, and irrigation channels. In most cases these sources are not protected, and are used indiscriminately for all purposes, including washing of dirty clothes and persons.

Drainage.—Generally speaking there is no regular system of drainage, only side ditches. Cesspools are common and receive the drainage of houses, or it flows into back yards, and so into the subsoil in either case.

Reference is made in the present report to the use of V-shaped drains for street drainage. In our "Suggestions" we have proposed the introduction of shallow-sectioned impervious surface drains to convey away all surface water or other liquids quickly to an outlet, and to keep them from filtering into the subsoil. V-shaped drains are generally made of stone with the edges laid together, but unless the joinings be made water-tight the fluid sewage may still filter into the subsoil. In using drains of this construction therefore, it is necessary to bed all the edges and joinings in cement, so as to render the drain practically impervious.

Conservancy, which means sweeping streets and removing the sweepings, was provided for in no more than 639 towns and villages out of 47,242 of these population groups.

"The towns and villages in which no such establishments exist are left to take care of themselves." And as the people have no idea of the relation between filth and sickness, the two of course go together. Mr. Price, Collector of Chingleput and President of the Local Board, has taken a warm interest in village improvements, and he again reverts to the subject in the present report. He again urges the provision of a minor municipal law giving the powers required for small local improvements, which had been previously objected to as involving increased taxation. But we have long since called attention to the general principles involved in the question, for in these small population groups there is very little which might not be done by the people themselves, and as the filth causes in every village house endanger not only the inmates but all the neighbours, the public principle is clear enough, namely, that no one has a right to use his property in such a way as to endanger the health or convenience of his neighbours, and as a result every householder should be called on to keep his surroundings in a wholesome state, or to pay someone for doing it. There are besides village officers and subordinates directly charged with seeing to the performance of these necessary duties, and what is really required, as it appears to us, is to reorganize this staff and set it to work.

There is no escape from the conclusion that unless this be done and a modicum of funds provided where required, the people will deteriorate in health and condition, and lives as well as property will be quite unnecessarily destroyed when epidemic seasons come round.

24. *Jails.*—The average strength of prisoners in 1881 was 10,322, admissions to hospital were 7,664, and 428 died.

The following abstract of admissions and deaths since 1874 through the period of famine and scarcity, 1877-78, will show the present state of prison health:—

Years.	Ratio per 1,000 admissions.	Ratio per 1,000 deaths.
1874	714·1	26·6
1875	752·6	58·7
1876	708·6	42·4
1877	971·3	175·4
1878	944·4	125·4
1879	890·5	55·8
1880	854·0	44·7
1881	742·5	41·4

It is satisfactory to see that the prison death-rate shows a tendency to return to its former position, and that as the condition of the people is improving the health of prisoners is also better.

Since 1878 there has been a great reduction in mortality from epidemics. In 1881 the deaths from cholera were 3·2 per 1,000, from dysentery 8·9, and from diarrhœa 6·8 per 1,000. Dropsies and anœmia together caused a death-rate of 3·3 per 1,000.

The chief disease feature of the year was the great prevalence of fevers of intermittent type. Out of 2,645 fever admissions 2,379 were of this class. There were 90 cases of cholera, of which 33 proved fatal and they all with two exceptions took place in the central and district jails, Trichinopoly. The central jail had no fewer than 84 cases and 33 deaths. The town of Trichinopoly itself, with a population of 75,306, yielded no fewer than 678 cholera deaths, or 9 per 1,000 of the population. With such a condition of the epidemic there can be no doubt that persons living under the usual restrictions of prison life would be in danger, and we have two "theories" of the origin of cholera in the prison, one leading to no practical action, the other leading to proper precautions.

"Theory No. 1" is as follows:—"The medical officer in charge thus reports. Cholera was prevalent "in the town 20 days previous to its outbreak in the central jail, and it was probably communicated "by contractor's servants, warders, and policemen coming into the jail from the town."

Not an atom of evidence is adduced to sustain this view, and of course its logical result would be to shut up the prison and to let the inmates get on as best they could without supplies. But the worst feature of the case is, that this view ignored altogether what appears to have been the real cause of the outbreak. This is given as follows:—

"Theory No. 2." The Inspector General of Jails, Colonel Tennant, writes:—"Whilst at Trichi-"nopoly, I visited the municipal filth depôt. It was evident that the filth had been thrown on the "ground and left seething in the sun, and not covered up in pits; the smell was something frightful, "and the filth lay exposed, although endeavours had recently been made to cover it over with earth. "When cholera was prevalent in the town, it is but reasonable to infer that choleraic discharges were "carted away with the filth and thrown on the ground at the depôt. The wind blew from the "direction of the filth depôt towards the market place, and I understand that cholera was very bad "in that part of the town. Mr. Johnston informs me that about the middle of November the wind "changed and blew directly over the depôt to the central jail. The distance from the filth depôt to "the central jail, I should say, is little more than a mile." Cholera appeared in Trichinopoly on 19th October, and 20 days after this would bring us to the change of wind and the outbreak of cholera in the jail. The case belongs to a well-known class which includes other diseases besides cholera, and not requiring cholera discharges to produce such results, and while we must agree with the Sanitary Commissioner that removal of the depôt is a necessary improvement, because such a measure would rest on actual fact, he has adduced no practical reason except the unproved opinion of the medical officer given above as "Theory No. 1," for quarantine procedure.

The subject is one of so much importance for the protection of human life that any alternative which could afford the slightest pretext to the municipality for not dealing with the filth depôt may in itself become a death cause.

25. *General Remarks and Personal Proceedings.*—Under this head the Sanitary Commissioner gives a brief summary of his own inspection work, in regard to which it will be sufficient to say that the disease causes he met with in villages may be classed, as in former years, under the heads of bad water polluted by filthy habits of the people and filth inside and outside houses, but he is disposed to think not unfavourably of native houses when compared with those of northern climates. He again reverts to the want of sufficient assistance for sanitary work, which, no doubt, is matter of necessity, but it is only one element in the reforms required for village populations in Madras Presidency.

26. In concluding these remarks on Dr. Furnell's Report for 1881, we consider—

(1.) That it affords evidence of sanitary progress, and on this subject we should have spoken more positively if we had been sure of the accuracy of the statistics. Had they been reliable there would have been matter for congratulation.

(2.) That there is no proof that Tirupati festival had any influence on the course of a true cholera epidemic which covered Southern India, and as regards the statement of mere unsupported opinion as to the spread of cholera by intercourse, it ought never to be admitted into any public report. At the bedside of the sick a medical officer has often to depend on general impressions and probabilities in forming his opinion, but on great questions of epidemic movement involving public interests, impressions and improbabilities can have no place.

The most carefully observed facts can alone be admitted as evidence, and even on this ground local facts may lead to error, unless taken in connection with the general history of an epidemic.

This matter has been fully dealt with in a letter from the Government of India to the Government of Madras on the cholera of 1881, in which it is clearly pointed out that the duty of the Sanitary Commissioner is to reject all mere opinions, and to sift the alleged facts in their relation to the epidemic, and they very justly say that "there can be no doubt that the publication of such theories "as are contained in this report is likely to prove most embarrassing, especially at the present time, "when the International Sanitary Boards at Constantinople and Alexandria not only eagerly accept "these theories, but immediately proceed to put them in practice, to the great disadvantage of "India." It is very much to be regretted that, at the present day, there should be found persons to propagate these groundless opinions, and that there should be others who do not scruple to act on them. It would almost appear as if the best way to deal with the whole question would be to treat it simply as a judicial one, without reference to professional opinions of any kind. The alleged facts are either true or not true, and they should be treated as any other facts may be treated in a court of justice.

(3.) In regard to improvements in towns and villages, we have laid down the general principles on which these should be carried out in our "Suggestions for the sanitary improvement of Indian "stations and their vicinity" (1882), and we are desirous simply of repeating what we have stated in former years, namely, that existing methods of dealing with villages, such as they are, should be better systematized, and the village officials called on to give practical effect to powers which they appear to have already. And we hope with the Government of Madras, that "in local fund circles "the Government trust that the several boards will soon see their way to making larger sanitary "grants than they do at present, especially for the improvement of village sites and of the water-"supply. As it is," they say, "the allotments, the Government regret to notice, were not fully "utilized. In no circle can it, in truth, be pretended that objects were wanting on which the money "might be usefully expended. The Board of Revenue are requested to pay special attention to this "matter."

We sincerely trust that the results of this enlightened view of the subject will show themselves in future reports.

25th June 1883.

No. 3.

Memorandum of the Army Sanitary Commission on the Report of the Sanitary Commissioner for Bombay for 1881.

1. Mr. Lumsdaine's Report for 1881 contains a full discussion of the census results of the year from which we propose to abstract the data bearing on the sanitary state of the population. These are as follows:—

Including the military population, numbering 35,660, the census returns showed that there were in the 24 Presidency districts—

Males	8,497,718
Females	7,956,696
Total	16,454,414

The area occupied by this population is 123,860 square miles, and the average density was 132·85 per square mile. The lowest density, 15·98 per square mile, was in Thur and Párkar district and leaving out Bombay city, which had a density of 35,145·27 per square mile, the highest district density was in Kaira, which reached 500·18 per square mile.

The population per square mile in each province stood as follows:—

Northern Deccan	131·18
Southern Deccan	172·93
Konkan	256·17
Guzarat	284·33
Sind	50·55

The numbers of population for ages under 20 cannot be given.

Arranged according to classes there were enumerated—

Mahomedans	3,106,482
Hindus	13,128,729
Christians	138,326
Other classes	80,877
Total	16,454,414

2. At the previous census of 1872 the enumerated population of that year was 16,276,886, but since then, Bombay Presidency has been the seat of famine, and the following differences in population, shown by the census of 1881, are partly due to this calamity :—

Divisions.	Increase of Population.	Decrease of Population.
North Deccan	65,917	—
South Deccan	—	365,286
Konkan	222,547	—
Gujarat	43,704	—
Sind	210,646	—
Total	542,814	365,286

The chief losses of population were in the Deccans. In the North Deccan the apparent increase was only 1·57 per cent. in 10 years, while the South Deccan lost 9·59 per cent. of its population, but the way in which increases and decreases are distributed in the districts appear to show that part of the gain or loss in particular cases was due to movements in the population. The actual gain in 10 years, however, was only 177,528 on the population of 1872, or 1·89 per cent.

3. *Births.*—There were registered in 1881 births of—

Males	239,912
Females	219,745
Total	459,657

This is the largest number of births yet registered in Bombay Presidency. The lowest number ever registered was in 1878, succeeding the famine, viz., 243,253 so that the population is rapidly recovering its normal rate of increase. There is one peculiarity in the birth registration which has never been fully accounted for, and this is the high excess of male over female births registered. For the last nine years 111·16 births of males have been registered in the Presidency for every 100 births of females. The largest increase of births in 1881, namely, 35·17 per 1,000 of the census population, took place in the Southern Deccan, which suffered most loss from the famine.

4. *Deaths.*—The deaths registered in 1881 were, of—

Males	202,166
Females	179,284
Total	381,450

The death-rate on the census population of 1881 was 23·18 per 1,000, and for every 100 female deaths there were 112·76 male deaths registered, which may be contrasted with the births according to sex in the same year, namely, 100 females to 109·18 males born. Death-rates varied greatly in different districts. The lowest registered, 6·56 per 1,000, was in Upper Sind frontier, where the rates hitherto registered have been much below the average. The highest registered rate in 1881 was in Broach district, namely, 37·91 per 1,000. The rates, according to divisions, were as follows:—

	Deaths per 1,000.
Southern Deccan	24·90
Northern Deccan	22·28
Konkan	22·14
Gujarat	31·39
Sind	13·22

The Sind death-rate is apparently under the truth, but in the other districts there has been much good registration work done.

Between 16 and 16½ per cent. of deaths took place in infants over the whole population, and 19·76 per cent. of total deaths were registered during the same ages.

5. *Causes of death.*—The following death causes were registered in 1881 :—

Diseases.	Total Registered Deaths.	Ratio per 1,000 of Population, 1881.
Cholera	16,694	1·01
Small-pox	539	0·03
Fevers	272,403	16·56
Bowel complaints	30,342	1·84
Injuries	5,950	0·36
All other causes	55,522	3·36
All causes	381,450	23·18

We shall discuss the leading facts of the year's disease history under each of these heads.

6. *Cholera.*—Cholera deaths, which were only 684 in number in 1880, rose to 16,694 in the following year. In the first quarter of 1880 there were 543 cholera deaths. In the second quarter there were only 24 deaths. In the third quarter there were 20 deaths, and we may connect the epidemic of 1880 with that of 1881 as follows. There were three deaths from cholera in October, two in November. There was then a sudden leap up to 92 deaths in December, and this was really the commencement of the epidemic which prevailed in 1881 in the following monthly proportions :—

Months.	Cholera Deaths, 1881.	Months.	Cholera Deaths, 1881.
January	79	July	2,618
February	47	August	6,568
March	23	September	3,327
April	20	October	1,403
May	344	November	500
June	1,499	December	266

Cholera in 1881 was not universally prevalent in the province. Sind division registered no cholera deaths. But the disease showed its presence in all the districts of the other Presidency divisions, with the single exception of Panch Mahals, in Gujerat, which escaped. Leaving out Sind division, there are in the other divisions 225 registration circles, of which 144 returned cholera deaths. In the divisions where cholera was present there are 21,026 villages, and all the cholera deaths were reported from 1,534 of these. There are 62 towns with an aggregate population of 2,102,645, 29 of which yielded 2,720 cholera deaths. The remaining deaths, 13,974 in number, were registered in country circles. The deaths registered in December 1881 would lead us to expect that this epidemic would pass over to the following year.

There are no data in the present report except those under the denomination of "conventional seasons" to show what was the relation between cholera prevalence and meteorology, and these it is unnecessary to reproduce.

Monthly climatic elements from localities where they might be usefully compared with monthly deaths from cholera appear to be at present unattainable, but this ought not to be so under a regularly organized meteorological department.

7. As an interesting contribution to local cholera history, we shall introduce the following abstract of a table given by the Sanitary Commissioner to show the relation of cholera mortality to attacked villages :—

Months.	Cholera Deaths.	Attacked Villages.	Months.	Cholera Deaths.	Attacked Villages.
January	79	7	July	2,618	212
February	47	2	August	6,568	329
March	23	3	September	3,327	359
April	20	4	October	1,403	146
May	344	24	November	500	49
June	1,499	80	December	266	19

These figures reproduce the experience obtained in other districts of India, namely, that the relative monthly mortality includes two factors, the number of attacked villages and the proportionate intensity of cholera at the time.

The next abstract gives the registered cholera mortality for Bombay Presidency during a period of 16 years to show the epidemic law of cholera :—

Years.	Total Cholera Deaths.	Years.	Total Cholera Deaths.
1866	28,927	1874	37
1867	5,143	1875	47,555
1868	6,847	1876	32,117
1869	52,830	1877	57,252
1870	2,666	1878	46,743
1871	5,821	1879	6,227
1872	15,642	1880	684
1873	283	1881	16,694

These data show a triennial period of increase. The three years 1876-77-78 were those of the period of scarcity, which was accompanied by an extraordinary outburst of cholera in other districts of India, as well as in Bombay. There is another table showing the law of cholera prevalence in Bombay city which it is worth while to give, because in this case the Sanitary Officer has made a decided inroad on the march of the law. In this case the data are for 33 years, up to 1880, and 34 years with 1881 :—

Years.	Total Cholera Deaths.	Years.	Total Cholera Deaths.
1848	69	1865	2,887
1849	2,128	1866	332
1850	2,997	1867	111
1851	5,485	1868	297
1852	1,520	1869	754
1853	1,148	1870	386
1854	3,507	1871	263
1855	1,645	1872	190
1856	1,846	1873	92
1857	2,161	1874	19
1858	115	1875	894
1859	1,985	1876	374
1860	1,961	1877	2,510
1861	641	1878	1,165
1862	3,170	1879	323
1863	2,209	1880	30
1864	4,847		

The cholera deaths in Bombay city in 1881 amounted to 529, while the 33 years' mean showed 1,453 cholera deaths. Since 1865 Bombay has received a water supply after the English model. It then was put under a sanitary police, which has kept up a warfare against filth; drainage was subsequently commenced, and is now being carried out. The epidemic has been dealt with in the following manner, as given by the Sanitary Commissioner for the year 1881, but it shows the measures usually followed when cholera breaks out:—"In every place in the native town where cholera broke "out the most prompt and stringent measures were taken. During one quarter no fewer than 500 "persons were removed from buildings where cholera showed itself. Prompt measures were adopted "wherever there was a presumption that a building, or a drainage, was defective. In other cases the "tiles were taken off affected buildings, and holes made in the walls so as to let in light and air; "earthen floors were dug up and sprinkled with carbolic acid, and the walls washed with carbolic "acid and lime, disinfectants were freely used in the houses and in the vicinity, improvements were "effected wherever the disease was discovered, air spaces were formed, floors were raised, and free "ventilation secured. Sulphur fires and sulphur fumigations were largely resorted to." During an epidemic the responsibility of all measures rests with the local sanitary authority, and it would be out of place to separate between the necessary and unnecessary in this enumeration. The public had confidence in what was done, and we can only deal with the probable results, which, in the present case have been sufficiently remarkable in the course of years of experience.

The years 1877 and 1878 in the above table were the famine and scarcity years, when the city became crowded by starving thousands from the adjacent districts, and they rather show what sanitary measures could accomplish under these exceptionally unfavourable conditions than what these measures had really done for the city. We shall, however, include them, and divide the whole series of years, 34 in number, into two groups of 17 years each, because during the last 17 years sanitary work has more or less been done. The following are the results of this comparison:—

Years.	Cholera Deaths.
1848 to 1864	37,454
1864 to 1881	11,026

There is plenty of sanitary work to be done in this great city of 773,196 inhabitants; but these facts, extending over a long series of years, appear to show that what has already been done has by no means been labour in vain. The figures do not even show the whole gain to public health, because while the registration has been improving with advance of sanitary work, and so exhibiting a more accurate enumeration of cholera deaths than could be attained in the first 17 years of the period, the population of the city has been rapidly increasing of late years, leading to an increase of crowding, and the cholera death-rates to population in the earlier years were hence much greater than the actual cholera deaths would show at first sight.

9. The present report contains a statement of cholera attacks, of which there were 34,883 reported in the Presidency. The deaths, as already stated, were 16,694 for the whole Presidency, or 47·36 per cent. of the attacks, and the cholera deaths amounted to 4·38 per cent. of the total year's deaths; a small matter when compared with the mortality from fevers, which amounted nearly to 72 per cent. of the total deaths of the year.

10. There is not much information given in the report as to the local causes connected with cholera prevalence, but what is given is in entire accordance with past experience, viz., that filth and bad water are the usual localizing causes. One outbreak in Ahmedabad Jail may be briefly noticed, on account of certain facts connected with it. There were 117 deaths from cholera in Ahmedabad city. The weather during the jail outbreak was very wet, close, and hot. All the sewage used to be buried in the jail garden, but after cholera appeared the sewage was removed by the municipality. Cholera stools were buried in the vicinity of the jail. All clothing, bedding, &c of cholera patients was burnt. Nothing is said about the water-supply. It is further stated that "All persons who were "attacked had been a considerable time in jail, and had no apparent communication from outside. ". . . . While cases occurred in all parts of the jail on the ground floor, there was only one "attacked in the cells on the upper story."

We mention this experience as the first of the kind which has been obtained from India, and, as a result of it, female prisoners were sent to the upper floors, which they were not allowed to leave.

The first cholera case in the jail was admitted on 16th July, the last on 20th July. There were 11 cases, of which five proved fatal. The outbreak was a local one, and no suspicion of spreading by intercourse appears to have arisen.

11. As a supposed case on the other side, of spread of cholera by contagion, we may mention the epidemic cholera in Surat, the first case of which was reported on the 23rd January, but the first case of what was considered to be the real outbreak took place "on 14th May, in the lines of the 10th "Regiment Native Infantry, and from this starting point the disease eventually spread in all "directions." Surat district had a population in 1881 of 491,125, and Surat town of 109,844. In the rural circles of the district there were 1,841 deaths from cholera, a mortality of 3·75 per 1,000, while the town yielded 910 cholera deaths, a ratio of 8·28 per 1,000. These 2,751 cholera deaths took place in 8 registration circles out of 10, and in 149 population groups out of 778, and the whole district had a cholera death-rate of 4·48 per 1,000, by far the highest district-rate of the year, and threefold the previous five years' cholera death-rate. The town-rate, 8·25 per 1,000, was very high, and the sanitary questions raised by the facts, as a whole, are as follow.

Seeing that cholera existed in considerable intensity in the country, to what removable causes was the excessive town-rate due? The more obvious surface causes appear to have been connected with Mahomedan and Hindoo feasts, which were held in filthy compounds and on ground of the foulest description. To remedy this state of matters, "additional scavengers were engaged, and strict "attention was paid to the removal of refuse. Public latrines and private privies were well looked "after."

But mere surface temporary work such as this could not, by any means, have reached the real disease causes. This is clearly shown by the Sanitary Commissioner, who, in giving the details of his own inspection, says,—"It has been my lot to visit many places where the insanitary conditions "were well nigh incredible, but never yet did I see such a whited sepulchre as Surat." The town contains 27,143 houses, the soil is open, there is no drainage, and the water-supply is brackish. Most houses have a cesspit for sewage, and another for fæcal matter, into which all the sewage and filth is passed, they are from 20 to 35 feet deep. In the town area, there are 16,000 sewage pits and 10,015 cesspools. "Every one of these is in direct communication with an inhabited house. . . . "Upwards of 100,000 persons live on an area honeycombed with 25,000 of these foul pits, and they "get their drinking water from wells sunk in the interspaces." During the rains, the sewage pits have to be closed and all refuse water is run into the streets. At the time of the inspection, "the "surface was literally swamped with stagnant pools of the foulest sewage." In order that there may be no mistake in this matter, the Sanitary Commissioner has given plans and sections, showing the deadly nature of these household arrangements, which (it may be stated) resemble closely those described by Captain Galton in his account of Memphis, U.S., in Vol. XIII. of the India Office Sanitary Reports, in which city they had decimated the population with epidemics, and almost destroyed the resources of the municipality. Again and again have attempts been made, by persuasion and compulsory rule, to improve the condition of Surat, but the one remedy not hitherto tried is simply that of affording the required facilities for water-supply and drainage, without which neither law nor philanthropic teaching can by any possibility be of use. *Captain Galton's* paper shows how a similar case has been successfully dealt with elsewhere.

Such being the facts of this cholera epidemic in Surat town, we are not surprised that the Government of India should have called the attention of the Government of Bombay to the extraordinary statement that, although the most searching investigation failed to find a cause for its origin, "the "extension was clearly due to human intercourse." Surely this is an example of opinion and facts starting from the same point and marching in quite opposite directions. We concur with the Government of India in deprecating the introduction of remarks of this character into official documents unless they are established by sufficient evidence, of which moreover there is no trace in this report.

12. *Small-pox.*—As already stated, deaths from this disease numbered 539 in 1881, or 0·03 per 1,000 of the population, by far the lowest number of small-pox deaths hitherto registered in Bombay Presidency. In North and South Deccan and in Gujerat the total small-pox deaths numbered only 26, and in the Konkan division there were 122 deaths, and all the others, 391 in number, took place in Sind, in which division there was not a single death from cholera.

In the two affected divisions the monthly incidence of small-pox mortality was about the same, and the following abstract will show what it was for the whole Presidency:—

Months.	Small-pox Deaths.	Months.	Small-pox Deaths.
January	26	July	37
February	65	August	26
March	79	September	13
April	89	October	12
May	81	November	5
June	86	December	18

In the North and South Deccan there are 9,797 villages, only eight of which yielded small-pox deaths, and these villages are situated in four out of 131 registration circles, showing how very sparsely the disease was distributed. In the Konkan 16 circles out of 46 registered deaths from 30

villages out of 5,454. In Gujerat all the deaths took place in five villages out of 3,275. In Sind where the disease attained something of an epidemic character, deaths were registered in 36 circle ous of 60, and in 154 villages out of 3,405.

These facts have an important bearing on the history of small-pox in Bombay in relation to the practice of vaccination, as may be seen by the following abstract, which places small-pox deaths alongside successful vaccinations and re-vaccinations since 1872 :—

Years.	Deaths from Small-pox.	Successful Vaccinations and Re-vaccinations.
1872	26,699	—
1873	9,935	527,088
1874	3,903	583,169
1875	3,461	681,600
1876	12,812	755,024
1877	27,369	764,918
1878	4,475	691,437
1879	1,156	581,051
1880	940	603,275
1881	539	661,994

The three years 1876–77–78 include the famine period when there was a great small-pox epidemic in other regions of India as well as in Bombay Presidency. If we leave these years aside and compare the first three with the last three years of the series, it would seem that vaccination has been influencing small-pox mortality. More experience would of course be required to establish such a conclusion, but there can in the meantime be no doubt in regard to two facts shown in the table, namely that a large amount of really good work is being done by the efficient vaccination service of Bombay, and that there has been a great reduction in small-pox mortality.

13. If we leave out the three years of famine and scarcity during which the birth-rate fell below the average, we find that for the years 1879–80–81 there were 1,118,400 births registered, while the vaccinations and re-vaccinations were 1,846,326 in number, but these latter include adults as well as children. Two official yearly results for 1880–81–2 added together will show better what the vaccination work amounted to :—

	Two Years.
Births	830,530
Children available for vaccination	700,066
Children vaccinated { under 1 year	530,429
Children vaccinated { 1 year to 6	284,473

This abstract shows that the vaccinations under one year exceeded five sevenths of the total number of children available, and amounted to five eights of the total births. The year 1881 was a year of low small-pox mortality. There were 459,657 children born. Of children under one year of age 282,480 were successfully vaccinated. The deaths under one year were 75,371, and of these deaths only 132 were from small-pox.

In discussions of data of this class we must always make allowance for the erratic nature of epidemics but taken simply as facts the data are remarkable.

14. In the course of the year 434 heifers were inoculated in Bombay where only animal lymph is used, and all succeeded except 34. The total number of heifers inoculated was 473, of which 38 failed. The cost was 327*l*. In Poona, animal and human lymph are both used, but vaccination from arm to arm is universal except in these two cities. In the official year 1881–82, 96·52 per cent. of primary vaccinations in the Presidency, and 71·65 per cent. of re-vaccinations were successful. The ratios for Bombay city, where only animal lymph was used, were for primary vaccinations 93·36 per cent., and for re-vaccinations 96·52 per cent. Further experience, however, would be necessary to show the relative value of each method.

15. The following was the vaccination establishment for the year :—

Deputy Sanitary Commissioners	5
Superintendents of vaccination	3
Inspectors of Sanitation and Vaccination	51
Assistant Superintendents, ditto	5
Clerks and karkuns	28
Vaccinators	432
Peons	481
Total	985

The total expenditure for the official year 1881–82 was 26,035*l*. The cost of each successful case was 3*s*. 10*p*.

The vaccination inspectorial work of the year included 5,289 encampments, 9,218 travelling days, during which 88,941½ miles were gone over and 14,762 villages were visited, and 343,632 children were inspected.

Details regarding the vaccination service are very complete, but there is no account of any sanitary inspecting or advising work having been done by the vaccination officers. We would strongly recommend that every Sanitary Report from Bombay should in future include all sanitary work of this kind, which has been done; otherwise we shall have to conclude that one of the main duties of this large establishment has still to be undertaken.

15. *Fevers.*—As we have already seen, the small-pox deaths in Bombay Presidency were 539, while the deaths from fevers, mainly due to unhealthy locality, were 272, 403. For every death from small-pox there were above 500 from fevers, which, besides cutting off so many in the prime of life, destroy the working power of those who survive. It is not out of place, therefore, in admitting the importance of vaccination work to ask whether it does not savour of large effort and expenditure mainly in a wrong direction, so long as local fever-causes are not grappled with. The following abstract of fever mortality will show how little impression, if any, has been made on its local causes :—

Years.	Fever Deaths.	Years.	Fever Deaths.
1872	206,747	1877	236,865
1873	188,201	1878	357,376
1874	187,717	1879	286,526
1875	219,156	1880	246,779
1876	220,833	1881	272,403

Even allowing for the higher mortality of the famine and scarcity years 1876–7–8, the rates of subsequent years show how comparatively unimportant to the public interests is the small-pox death-rate when contrasted with the fever-rate, for the reduction of which so little has apparently been done.

16. In 1881 fever deaths were registered in all the 285 registration circles, with a solitary exception in Kaladgi district, and from 23,863 villages, out of a total of 24,431, showing the universal prevalence of the disease. The following were the monthly deaths registered in 1881 :—

Months.	Fever Deaths.	Months.	Fever Deaths.
January	24,742	July	20,458
February	21,987	August	25,000
March	21,334	September	24,734
April	24,322	October	24,725
May	18,882	November	26,069
June	17,774	December	26,273

Of the year's fever-deaths 241,547, took place among a country population of 14,351,769, equal to a death-rate of 16·83 per 1,000. In the towns, 62 in number, with an aggregate population of 2,102,645, there were 30,856 fever deaths = a death-rate of 14·67 per 1,000. The fever death-rate for the whole Presidency was 16·56 per 1,000, against a previous five years' rate, which included the famine period, of 17·76 per 1,000. The highest district fever death-rate of the year was 33·14 per 1,000 in Broach, the lowest, 5·37 per 1,000, was registered in Upper Sind frontier district. The Belgaum cantonment had the lowest fever death-rate of the year, namely 5·53 per 1,000, and the highest town rate was 52·76 per 1,000 from Viramgan town in Ahmedabad district.

17. The usual difficulty presents itself in dealing with fever mortality on account of the vagueness of the nomenclature. One of the Deputy Sanitary Commissioners considers that the actual fever mortality is no more than a fifth part of the registered death-rate from this cause. We have often called attention to probable errors in classifying deaths preceded by febrile symptoms, but there are plenty of facts to show that this opinion greatly understates the actual fever mortality. We have suggested on other papers that possibly the best test to adopt when deaths from fever are reported would be to ascertain whether there had been completed paroxysms. The heat test by itself is scarcely sufficient.

18. The only statement on the subject of fever causes is the following, quoted from a report of the same Deputy Sanitary Commissioner, in regard to North Deccan fevers. He says :—
"I consider all these diseases, viz., cholera, fever, and bowel affections, are propagated by "contaminated water, and if the death-rate is to be diminished it can only be done by giving each "village a good supply of clean water, and I hold that a public well under proper supervision in "every village is a necessity more frequently calling for support, and is of more primary importance, "than education or hospitals, or any of the hundred and one demands made upon and granted out "of village funds, whether local or municipal."
"There is no doubt of the importance of this recommendation, which is, indeed, one we have long ago made, a good village well or wells, dug in clean ground and away from all sources of surface impurity, with the immediate subsoil water cut off in the way shown in our revised "Suggestions," having the tube of the well raised above the ground level, and the surface carefully formed to drain

water away from the tube. These simple precautions, and an iron windlass, bucket, and chain for drawing, and a cover for the well above, would ensure a pure water-supply for every one, and would apparently present no caste difficulty in their operation. But there is plenty of experience to show that, while admitting the great danger to health of water containing putrescing animal matter, the purest water, even distilled water, would afford no protection against either fever, cholera, or bowel complaints, if other well-known causes of these diseases were left untouched. The duty of the Sanitary Officer is by no means confined to discussing points of what may be called water-etiology. The questions to be dealt with are by no means so simple. Health and disease, so far as their outward conditions are concerned, are the result not of one condition, however important it may appear, but of many, and there is no short road to knowledge in such matters. Water unfit for human use on account of animal impurities is something else besides a disease cause. It is a sign of filth and want of cleanliness about the water source or in the subsoil which supplies it, and no amount of well digging will be a permanent advantage unless village cleansing and surface draining go along with it.

19. The known causes of fatal malarial fevers in India may be here adduced as showing their probable nature in Bombay Presidency until we obtain more definite information on the subject. They are local filth and local damp, or wetness of subsoils under and around village sites and houses; cesspits; bad water, consequent on filth; damp houses and subsoils, consequent on want of surface drainage or from subsoil infiltration from rivers, from irrigation, where too much water is used, or from tanks or water springs on higher levels; overgrowth of jungle; keeping cattle in houses or compounds; sources of malaria in nullahs, wet land in which water stagnates, and the like. The more immediately important causes are those arising from want of cleanliness, with which the people might deal at once. The exact importance of each of these disease causes in any given case forms the problem with which the Sanitary Inspector has to concern himself, because on his decision depends not only improvement of health, but direction of expenditure.

In all such inquiries personal causes, such as deficiency of food and of clothing, have to be taken into account, but we have Indian experience on record to show that deaths from malarial fever take place in families where such personal causes are absent. Possibly, as the Sanitary Commissioner suggests, some of the malarial fever mortality may be due to typhoid fever. This is no doubt probable, but it would not account for the enormous fever death-rate.

20. *Bowel complaints.*—Deaths classed under this head numbered 30,342, yielding a death-rate of 1·84 per 1,000, against a previous five years' average rate of 2·28 per 1,000. The registration of this death cause presents the usual anomalies of general distribution of deaths which were local in their incidence. Bowel complaint deaths were returned from 267 registration circles out of 285, but out of 24,431 villages all the deaths were returned from 5,797.

Arranged according to months, the registered mortality in 1881 stood as follows:—

Months.	Bowel Complaint Deaths.	Months.	Bowel Complaint Deaths.
January	2,233	July	2,636
February	1,884	August	3,785
March	1,984	September	3,375
April	2,117	October	3,082
May	2,187	November	2,567
June	2,047	December	2,505

Of these deaths the towns yielded 4,581, equal to a death-rate of 2·18 per 1,000. The country districts registered 25,761 bowel complaint deaths, or 1·80 per 1,000. The preceding abstract shows that the deaths rose during the rains. No account is given of the local causes.

21. *Injuries.*—The following abstract classifies the death causes under this head in 1881:—

Causes.	Deaths.
Drowning	2,636
Poisoning	113
Hanging	217
Wounding	382
Wild beasts	120
Snake-bites	1,209
Other causes	1,273
Total	5,950

Of these deaths, 3,424 took place in males, and 2,526 in females

Of the drownings, 320 were suicides in wells, and 32 in tanks. There were also 956 accidental drownings in wells, and 345 in tanks, so that 1,653 persons were drowned in water-supply sources in the course of the year.

Deaths from snake-bite exceeded by 30 those of the preceding year, and the following abstract shows the monthly prevalence of this death cause:—

Deaths from Snake-bite.

Months.	Deaths in 1881.	Mean of 5 Years.
January	39	30
February	34	24
March	55	45
April	55	49
May	93	93
June	162	135
July	191	164
August	165	159
September	161	160
October	128	144
November	80	68
December	44	39

According to this table deaths from snake-bite have been increasing, and it apparently shows us at what period of the year war against snakes ought to be most vigorously followed up.

22. *Other causes.*—In the course of the year 55,522 deaths were registered, or 3·38 per 1,000 of the population, of which no classification was made.

23. *Sanitary works (Military).*—The actual outlay under this head in 1881 was 42,210*l.*, by no means a large sum, and of the amount 24,310*l.* was spent on the new water supply of Nasirabad. Most of the work paid for during the year appears to have come under the head of current repairs or small local improvements not bearing very directly on the sanitary state of barracks. Still works useful in their way have been done, and amongst these the following may be enumerated.

Water-supply of Nasirabad, referred to from the Danta reservoir, nearly completed and laid on to European Infantry, Royal Artillery, Native Infantry, and Native Cavalry lines by hydrants and standposts. We shall notice this work further on.

Improving drainage of Ghorpuri lines, Poona, and at Kirkee. Planting trees for protection at Poona, Kirkee, Colaba, &c.

Improving the ventilation in Ghorpuri barracks by wire gauge doors to break the inflowing currents.

Improvements in surface drainage at a number of stations, but it is not satisfactory to find Rs. 12 expended in making a cesspit for refuse water Mhow. All such water should be drained away.

New accommodation was provided or commenced in the course of the year, chiefly in Aden. Latrines were improved, and also well water supply at some stations.

There appears to be nothing more under this head which requires notice.

24. *Sanitary works (Civil).*—This section of the present report gives a very brief abstract of sanitary work carried out during 1881 in 162 municipalities, and somewhere about 75 local fund circles.

The Sanitary Commissioner describes the reports as being "exceedingly valuable," but too long for insertion.

The total income of the municipalities was 256,979*l.*, and the expenditure on conservancy was 63,371*l.* This, of course, is exclusive of the city of Bombay, which has its own sanitary administration.

There are some points in the abstracts of municipal reports which may be noticed.

25. *Ahmedabad city* contains a population of 124,767, and had an income for the year of 27,389*l.*, out of which 5,351*l.* was spent on conservancy.

Its water-supply is raised from the river by pumping engines to settling tanks, from which the water passes into filters, and thence into storage tanks. Most of the distribution mains are earthenware pipes, and water is drawn for use by means of iron stand pipes and reservoirs. The only drainage is effected by open side drains along the streets. There are no cesspits. Latrines, public and private, are in use, all of which are cleansed by the municipality. All sweepings are burnt, and the ashes are mixed with night-soil and sold for manure. There are 27 iron-screened urinals. Markets, burial grounds, and cremation grounds are also provided. Ahmedabad has been improved on certain well-defined principles, which ought to furnish public health data for use elsewhere, but as we shall see the apparent results are no other than such as are usually adopted as proof of bad sanitary condition, for the same report shows that the death-rate of the city in 1881 was no less than 55·57 per 1,000, and that even this very high rate was not exceptional, for the previous five years' average was 57·75 per 1,000, both of which rates should be compared with those of Bombay, allowance being made for the fact that Bombay has a population of 773,196, above sixfold that of Ahmedabad. The Bombay death-rate in 1881 was 27·87 per 1,000, and had fallen much below its previous five years' average, which was 38·12 per 1,000. The decennial death-rate of Calcutta had been 28·7 per 1,000, and the rate of 1881 was 1·3 per 1,000 higher, or 30 per 1,000, on a population of 433,219.

26. We have suggested this comparison, because it has an important bearing on the class of sanitary works required in populous Indian cities. Bombay and Calcutta are being improved on a different basis of works from the plans adopted in Ahmedabad, Cawnpore, and elsewhere, and in advising an inquiry into the causes of high death-rates in Ahmedabad, which we are of opinion is necessary from the facts, we would suggest that the influences of these different methods of draining should be included.

The most striking fact on the year's death-rate is that shown in the following contrasted rates of the three cities from fever, to which Cawnpore may be added :—

	Fever Deaths per 1,000.
Ahmedabad	35·65
Cawnpore	33·96
Bombay	8·29
Calcutta	8.60

The practical points suggested by the facts are,—1st. What are the causes of the high death-rates in Ahmedabad? 2nd. As the present works have not lowered the rate to those of the much more populous capital cities, could any change in the procedure effect this object; and if not, why not? The suggested burning of the city sweepings in the report within the walls of Ahmedabad would scarcely help us to a solution.

27. The next populous town which may be noticed is Surat, of which we have already given some account. It has a population of 109,314. Its annual death-rate for five years had been 23·37 per 1,000, much below the truth, apparently. In 1881 the rate was 38·32 per 1,000, of which 21·99 per 1,000, not far short of the entire five years' rate, was due to fever. The city contains 8,296 cesspools, it has no drainage except for surface water. Its water-supply is from wells in foul subsoil, or from the brackish river.

The only approximately satisfactory statement about Surat is, that the authorities have "under consideration" a scheme for supplying the place with water and drainage.

There appear to be complaints of the difficulty of improving the sanitary condition of Surat by fining people. How could it be otherwise? Let the authorities first drain Surat, and fill up all its cesspools, bring in water, and fill up all its wells. Give the people facilities for being clean, and then fine them if necessary.

28. *Nasik.*—A carefully prepared account of the sanitary condition of Nasik, by Mr. Hewlett, enables us to form a fair estimate of the condition of many similar towns. According to the census of 1881, its population was 23,766. Its average death-rate has been 50·79 per 1,000 during the previous five years, and 46·62 per 1,000 in 1881. Of this latter rate, no less than 29·45 per 1,000 was due to fevers. The town is built on the summit and slope of ground falling towards the Godaveri river, at a height in the higher parts of 1,943 feet above sea level, and 64 miles distant from the sea. The subsoil is disintegrated trap rock, which absorbs rain, and is a source of water for the river Nasardi.

It would occupy too much space to enter on the numerous sanitary details collected by Mr. Hewlett, including as these do, not only an account of different town areas, but the municipal sanitary arrangements and proposed remedies. It will be enough to state that the inquiry points clearly to the operation of insufficient drainage and want of pure water as disease causes to be dealt with by engineering works. There are drains of a kind, but it is doubtful whether they are of use. Deposit accumulates in them, and Mr. Hewlett says they are not properly cleansed. There are 245 cesspools in the town, together with 1,400 private privies and 25 public latrines, for the cleansing of which there is a considerable staff entertained, and the night-soil is converted into poudrette, but Mr. Hewlett says that the principal part of the urine is not removed, but escapes into the drains, where it decomposes or finds its way into the river. The poudrette process consists in burning the town sweepings and mixing the ashes with night-soil, and allowing some drying to take place, it is then sold at four annas per cartload.

There are 825 wells in the town, but the chief source of drinking water is the Godaveri. From the topography and subsoil of the town, it appears that both well and river waters contain evidence of sewage impurities. This brief statement of facts appears to bear out Mr. Hewlett's conclusion; he says, "the tables of mortality prove that a persistently high death-rate always obtains in Nasik, and "its cause is, in my opinion, chiefly due to impure water and to an atmosphere vitiated by the "dangerous emanations from the drains."

Nasik is a very old city, and it is not unlikely that part of its persistent high death-rates, especially from diseases of the epidemic class, may be due to the condition of the subsoil. On a ten years' average, cholera mortality has been 2·76 per 1,000 per annum, small-pox 1·34 per 1,000, fevers 21·04 per 1,000, and bowel complaints 2·31 per 1,000. The municipality appears to do what it can to improve the public health by temporary measures and with limited means, for its revenue is little more than 4,000*l.* a year. The amount allotted to public health in 1881 was only 1,814*l.*, and the present death-rates appear to continue after many years' trial of these methods of improving public health. All we can do is to point out the steps which Mr. Hewlett's facts appear to render necessary:—

1. With properly laid down street and road surfaces, all rainfall might be passed to the river.
2. The present unwholesome drains might be replaced by pipe drains to drain the houses.
3. Drains of this class would have to be connected with a town water supply, which is urgently required.
4. And, instead of passing sewage into the river, it might be applied for agricultural purposes.

In the meantime, it is worthy of consideration whether the present underground drains might not be advantageously dispensed with, and shallow surface drains, simply for the removal of rainfall substituted for them. Water must be obtained anyhow, and, when brought into the town, it must be removed after use or the fever-rate may be raised. Apparently a combined system of works would be more advantageous in the end.

29. *Ahmednagar* is another unhealthy city. Its population is 32,798, its five years' death-rate was 45·81 per 1,000, which in 1881 had risen to 54·91 per 1,000, of which 16·01 was due to fever, and 6·74 to cholera.

Water is obtained from three aqueducts, from the river, and from 39 public and 350 private wells. There appear to be two sets of drains. One underground, which conducts a small quantity of sewage for irrigating fields leased at 15*l.* a year; the rest of the drains consist of masonry conduits, cleaned out every year before the rains, and some are mere surface cuttings. Cleansing is done by the municipality, which sold the manure and street refuse for 219*l.* Ahmednagar has a water-supply, which no doubt, could be extended and improved, but as it is not at all unlikely that pouring in a constant volume of water into the city, without means for its removal, may be a disease cause, it is satisfactory to learn that a drainage scheme is under consideration. The municipality has clearly shown that cleansing may be made to pay, and there is every prospect that, if the water-supply were connected with a suitable drainage system, and the sewage applied to the land (as is done on a small scale at present), the sewage would, at all events, be safely disposed of, and possibly some portion of the outlay might be recouped. The death-rates clearly show that the whole case as regards the public health has not been met by present procedure.

30. *Poona.*—It is scarcely necessary to discuss the sanitary state of Poona. It has already a water-supply; and a system of drainage, combined with application of sewage to agriculture, is at present under consideration.

31. The examples we have given above will be sufficient to show the nature of sanitary engineering problems among the larger population groups, as brought out by the Sanitary Commissioner's inquiry. So far as we can see, all of them can be dealt with on the principles laid down in our revised "Suggestions." The application would, of course, have to be varied to suit local conditions, but the principles would remain the same.

A similar remark applies to the case of smaller municipal towns, of which many are briefly noticed under this section of the Sanitary Commissioner's Report. They have all certain features in common, such as damp, undrained sites, cesspits, wells dug in foul ground, or what may easily become so, doubtful water tanks, &c., but in the same suggestions we have given methods of dealing with such cases where funds for permanent works are not to be had at present. In many of them, the epidemic death-rates are high. The foundation of all progress in these small towns is cleansing and keeping clean. In many cases, as shown by the notes, considerable improvements of a simple kind appear to be currently effected, but their death statistics show that increased activity in sanitary work is needed.

32. In the *Local Fund Circles*, which include village sanitary work, the chief information given refers to improvements in wells and water sources, such as repairs, sinking new wells, and the like. There is little information as to the epidemic disease causes, and all that can be said is that so far as work is described as having been done it has been done in the right direction.

33. *General Remarks.*—Under this head are placed a number of separate reports on water-supply, certain of which we have already referred to, but there are others which merit separate notice.

34. *Thana.*—This town has a population of 14,456, its five years' average death-rate was 23·35 per 1,000, and its rate for 1881 was 20·27 per 1,000, of which 15·63 was due to fever, and 0·55 per 1,000 to cholera. In July 1880, a water supply-scheme, prepared by Mr. Mackaren, C.E., was sanctioned, and water was supplied to the town in 1881. The source is an impounded reservoir, with a dam 1,005 feet long and 31½ feet high. The surface water area is 489,400 square feet, and the contents 27,000,000 gallons. There is an outlet tower and valves, and the discharge pipe, 10 inches in diameter, is carried in a trench cut in the solid rock below the dam, and filled in with concrete. The cast-iron pipe to the town is 7 inches in diameter and 10,365 feet in length, having a fall of 103 feet. At the town end is a meter-house, whence the water is passed into cast-iron pipes, and so to hydrants (of which there are 16) for use. The available supply is calculated at eight gallons per head per day, and the cost was 8,463*l.* Drainage is a necessary complement of this augmented water-supply. Thana has 61 cesspools of brick and lime, and 98 common pits. The streets are side-drained, but (as the drain pipe is really the other end of the water-pipe) it may be suggested whether so excellent a work as this water scheme should not be connected with a drainage system, and these cesspits abolished.

35. *Pandharpur.*—Water-supply is provided on similar principles to that of Thana. The town had a population in 1881 of 16,910, liable, however, to considerable increase during pilgrimages. The number actually provided for was 25,000 at 10 gallons per head per day. To effect this object a catchment area of 10 square miles was finally adopted after trial, and has been found sufficient. The subsoil is trap, and the surface is covered with light grass, or partly with cultivation and a few trees. The rainfall on this catchment area averages 26 inches, but the extremes lie between 6·84 and 36·60 inches. An actual experiment, made in September 1880, gave the following results:—Rainfall in three days (12th to 15th), 6·75 inches. Amount of rain falling on catchment area, 156,816,000 cubic feet, of which 46,742,542 cubic feet flowed into the tank = 0·297 of the fall. The tank is placed at the end of the catchment area next the town. It has an available cubic capacity (after deducting the "bottom") of 79,166,983 cubic feet, and an area at the level of "full supply" of 196 acres. Water is passed through screened openings to the distributing reservoir, where, after filtration by a temporary arrangement, it is led into the town about four miles off by a 10-inch main, subdivided into eight and six inch mains, and finally distributed by 38 stand-posts, with one, two, or

four push-taps, which are said to answer well. The works are still to undergo improvement. The filtered water, as analysed by the Government analyst, gave 11·2 grains total solids per gallon, of which 2·4 were chlorine combined, 0·02 parts per million free ammonia, and 0·15 per million of albuminoid ammonia. The process of filtration removes a considerable quantity of vegetable *debris* and low forms of animal and vegetable life. The water is not all that could be desired as regards purity; and it is proposed to remove a village in the catchment area, and to restrict the use of manure. It is of course one of the conditions of water-supply of this nature that perfect cleanliness of the ground and of all open conduits should be maintained. But another condition is, that water brought into a town should be again removed after use by drainage. As "there is hardly one single "well in the town or suburbs of which the water could be said to be fit for drinking," it would seem that filling up these wells was a corollary of improved water-supply.

36. *Nasirabad water-supply.*—On account of numerous cases of enteric fever at this station, we advised that a special examination of it should be made by the Sanitary Commissioner. This has been done, but, unfortunately, most of the troops were absent. The Commissioner says that as he found the station "there were absolutely no insanitary conditions, and no apparent causes to which "the past sickness could be assigned."

There is, however, an apparent exception to this view in the account given of the water supply, which is derived from a well at the village of Dilwarra, two miles away, and has been used both by the people and for supplying water for troops. This well borders on a public road, and is apparently below the level of the village. The people draw water from it in the usual way by ropes and vessels. The well is uncovered, and there is cultivation close up to it. The following is an analysis of the water:—Total solids, 28 grains per gallon, including 3·5 grains of combined chlorine; free ammonia, 0·02; and albuminoid ammonia, 0·14 parts per million. "Before my visit," says the Sanitary Commissioner, "it had been cleaned out, and several cartloads of black mud were removed. "There was no available record of former cleanings."

There can be no manner of doubt that this statement indicates a grave danger to troops using such water; but we have no means of knowing to what extent it predisposed the men to enteric fever. The danger has been recognised, and water for the station is partly obtained from Danta lake, a proposed future source of supply. This is a newly-constructed reservoir about six miles from Nasirabad, whence water is brought by gravitation to stand-pipes within the lines.

The analysis of the water is unfavourable to its purity. It is as follows:—Total solids, 15·4 grains per gallon; chlorine, 4·2 grains per gallon; free ammonia, 0·24 parts; and albuminoid ammonia, 0·32 parts per million. It contains a large quantity of vegetable *debris*, and of animalcular life. The analyst pronounces this water, as well as that from Dilwarra well, as being "bad," and he is quite right. Before, however, the Danta lake water is condemned, the gathering ground and its surroundings should be carefully examined. The whole area must be kept free of every source of impurity, and measures would have to be adopted continuously for this purpose. If the collecting ground is protected from sewage and refuse vegetable matter, filtration would do what is needed, but not filtration as it appears to have been conducted by barrack filters, for there is an instance given of a barrack filter having added above 11 grains per gallon to the impurities in Dilwarra well water, obviously from neglect of filter cleaning.

The Dilwarra well is quite unsuitable for the supply of troops, and if the Danta lake does not supply the want, then the only other resource would appear to be to dig a special well for the station in new clean ground, away from every source of pollution, and to adopt the supply arrangements we have described in our revised "Suggestions." All other wells within station limits should be closed. They cannot be depended on. One of them, in the artillery horse lines, yielded no less than 123·2 grains of chlorine per gallon, showing an extraordinary degree of subsoil pollution.

The bazaar at Nasirabad requires improvement in its sanitary condition, but the hazardous condition of the water-supply is the main insanitary condition established by this special inquiry.

57. *Sholapur water-supply.*—We quote the following account from the Report:—

"The town is now supplied by gravitation. The water is taken from the Ekrûk perennial canal, at the fourth mile, and is first passed into a settling tank. It is then led to a well in the engine house, from which it is pumped into two reservoirs at different levels. The supply is five gallons per head per diem for 50,666 persons. The distribution is by pipes and hydrants, the quality is good, and all the arrangements are everywhere excellent."

Here is the analysis of water drawn from a stand-pipe:—Total solids, 10·85 grains per gallon, of which chlorine combined 1·05 grains, free ammonia 0·005 parts, and albuminoid ammonia 0·07 parts per million. Now, by way of contrast, let us insert the analysis of a Sholapur town well:—Total solids, 45·8 grains per gallon, of which chlorine combined 11·2 grains, free ammonia 0·02 parts, and albuminoid ammonia 0·04 parts per million.

Can this great change in the character of the water-supply have had any part in the following statistical results to the public health? Five years' average death-rate preceding 1881 = 71·77 per 1,000. Death-rate 1881 = 29·36. But of this rate 20·14 per 1,000 was due to fever. We may ask the question, What means have been adopted for completing the new water-supply by removing the large quantity of water brought into the town after it has been used?

38. *Hyderabad water-supply* is derived from the River Indus, and, after passing through settling tanks, it is conducted for two miles in a conduit, and then to a service reservoir within the fort, whence it is distributed to the town. The (daily?) consumption in the hot season is 169,800 gallons for the town, and 74,900 for the cantonment, and about a third less during the cold season. The

population of Hyderabad town is 45,195. Its death-rate in 1881 was 24·41 per 1,000, against a previous five years' average of 46·42 per 1,000.

39. *Karachi water-supply.*—After 20 years' delay, the projected works for this object are approaching completion. Water is obtained in unlimited quantity from a porous water-bearing bed close to the Mullee river, at a distance of 18 miles east of Karachi, by conduit to the town. There are two wells, within each of which is a cast-iron valve shaft, with three 24-inch regulating valves worked from the ground level. From the main delivery valve a 24-inch cast-iron pipe will be laid for a mile and a quarter, opening into a masonry conduit built of rubble, and lined with Portland cement. Its sectional area is 5 feet 6 inches, with a minimum fall of 3 feet 9 inches to the mile, and its length is 16 miles. At the Karachi end of the conduit the water is received into an inlet well 20 feet in diameter, alongside the distribution reservoir, which in its turn is capable of holding two millions of gallons, and means are provided for taking the town supply either from the delivery well direct or from the reservoir. It is proposed that the delivery main shall eventually be a 24-inch iron pipe to the town and camp. The mains and sub-mains and distributing pipes in the camp and city are of the ordinary description. In all streets where mains are laid, stand-pipes, bullock and street services, are to be erected.

The daily supply will be 25 gallons per head for 80,000 persons.

The present population of Karachi is 68,332, and its death-rate in 1881 was 21 per 1,000 for all ages, while the death-rate among European troops was 26·61 per 1,000 one third of which was due to enteric fever.

The report on the new water-supply is illustrated by plans and sections, one of which is of special interest in its bearing on the sanitary state of the troops there. It is a map of the station and surrounding country, on which is shown the average wind directions in relation to the position of the cantonments, of the town, and of marshy back-watered land. This unhealthy exhaling surface is many square miles in area. One side of it comes to within a mile of cantonments, and the whole area as well as the Native town itself lies to the windward of cantonments, which receive the wind blowing over both for 247 days in the year. We are afraid that these topographical conditions point to disease causes which admit of but one remedy,—removal to a better site. The question may be asked whether a site which would escape the marsh wind altogether might not be found somewhere about Ghizree.

40. These are the chief points requiring notice in the section of *General Remarks*. There is, besides, a long and useful detail of information on the subject of sewage irrigation with reference to the Poona drainage scheme at present under consideration. There is, further, a note by Mr. Hewlett, showing that since 1875 much good sanitary work had been done in Poona. There is also information about Bombay city water-supply, a matter belonging rather to the Bombay municipal report, and there are some details given on the subject of animal vaccination in Bombay, but these belong to the vaccination department.

41. We have said enough to show that Mr. Lumsdaine's Report for 1881 is one of much importance to the progress of sanitary work in Bombay Presidency. By a few test cases, he has shown what is probably the sanitary state of every large population group, and he has also shown by examples that, so far as water-supply is concerned, principles which have been long in use in England are applicable in India. As we have already stated, we should have been glad to have had some information as to sanitary work done in villages under supervision and advice of vaccination officers. But, so far as information is given in the present Report, we see no reason why the sanitary principles we have laid down in our revised "Suggestions" should not be taken as the foundation for improvements in towns, villages, and stations, and this is the practical result of the Report.

42. We desire to make only one other remark referring to papers submitted to us by the India Office, in which Mr. Lumsdaine discusses certain remarks previously made by us on passages in his preceding Report, about cholera. These remarks applied solely to matter of sanitary principle as distinguished from disease theory, and the explanation which Mr. Lumsdaine has given of those he himself made fully show that his views were not intended practically to differ from our own; and, in conclusion, we entirely adopt the following opinions in regard to the Bombay sanitary service with which the Government resolution on the Report under review concludes:—

"The Deputy Sanitary Commissioners, without exception, deserve the thanks of Government for the zeal which with their duties have been performed. As the Report under review is the last annual Report which Mr. Lumsdaine will submit to Government, His Excellency the Governor in Council takes this opportunity of recording his appreciation of the conspicuous ability with which that officer has discharged the duties of Sanitary Commissioner for more than 11 years. The ardent interest which he takes in his work is shown in all his annual Reports, and not least in that under review."

We may add to this estimate that Mr. Lumsdaine had to organise the Sanitary Commissioner's department for Bombay Presidency.

15th June 1883.

No. 4.

MEMORANDUM of the ARMY SANITARY COMMISSION on the REPORT of the SANITARY COMMISSIONER for BENGAL for 1881.

1. The population of Bengal, of which the census of 1881 was taken, and not including certain outlying hill districts (Naga) was as follows:—

Males	34,220,905
Females	34,601,015
	68,821,920

On account of the absence of certain district details this total is under the truth by about 8,000. The population, excluding that of Naga hills, which should form the basis of vital statistics in future years is hence 68,829,920. That of the previous census of 1871 numbered 62,709,405, showing an increase in the decennial period of 10 per cent.

From among the census population of 1881, there were registered the following deaths:—

	Number.	Ratios per 1,000.
Males	686,825	23·02
Females	568,653	18·92
Total deaths	1,255,478	20·96

The total mean death-rate of previous years was 16·69 per 1,000, a fact which shows, not that the year 1881 was a specially unhealty year, but only that the registration had improved, for it may be safely assumed that none of the death-rates hitherto registered represent the actual annual mortality.

Perhaps a nearer approach to the actual mortality is the average death-rate of 33·47 per 1,000 for 96 towns in the province of Bengal for 1881, against an average of 29·84 per 1,000, during the previous five years.

3. Registration of births was carried out in 1881 in 46 municipalities and towns, having an aggregate population in 1872 of 1,552,672. There were 20,608 male births, and 18,248 births of females registered; together 38,856 births, equal to a birth-rate of 25·51 per 1,000.

The distribution of birth and death rates among different districts and towns shows the usual variations which it is unnecessary to discuss, as their main result bears more directly on the condition of registration than on the actual facts.

Their teaching of course is, that efforts at present being made to improve the registration machinery and its agents require to be continued and extended.

Chief diseases.—The following proportions of deaths from the ordinary causes were registered in 1881:—

Diseases.	Total Deaths.	Deaths per 1,000.
Cholera	79,180	1·32
Small-pox	24,971	0·40
Fevers	940,911	15·71
Bowel complaints	57,029	0·95
Injuries	21,553	0·36
All other causes	132,932	2·21
All causes	1,255,478	20·96

Under the head of injuries are included 9,502 deaths from snake-bite and wild beasts, a small part, no doubt, of the total mortality, but showing that there is room for considerable improvement in this part of the public health work.

There is the usual large proportion of deaths not assignable to any of the registration headings, but at present there is little prospect of any certain account of these deaths being obtained.

5. *Cholera.*—As epidemic cholera is a well-known disease among the people of Bengal, we may safely assume that the recorded deaths, 79,180 in number, represent approximately the year's mortality from this cause. The death-rate was 1·32 per 1,000, contrasting favourably with the average rate of 2·08 per 1,000, which ruled during the preceding five years. There was, nevertheless, a large increase of cholera deaths over those of 1880, which numbered 39,643. The death-rates per 1,000 since 1875 have been as follows:—

Years.	Ratio per 1,000 Cholera Deaths.
1875	1·80
1876	3·27
1877	2·58
1878	1·58
1879	2·27
1880	0·66
1881	1·32

Last year, 1880, showed the lowest registered cholera death rate on record. The cholera of 1881 was by no means equally distributed over the country. It was chiefly confined to the sea-coast from Poori along to the north-east, where it spread over most of the Ganges delta. The region traversed by the rivers Gundick, Ghogra, Ganges, and Sone, near their points of junction also suffered. The remainder of Bengal, that is, by far the greater area of the province, suffered very little. In the preceding table the cholera death-rate for seven years is given, and if the central year 1878 be left out, we find that the deaths from cholera in the years 1875-76-77 were nearly double the number of those which took place in the last three years of the series. This at any rate is a hopeful result.

Divided between the town and country populations the cholera death-rates in 1881 were as follows:—

	Cholera deaths per 1,000.
96 towns	3·01
44 country districts	1·25

The highest town-rate was that at Poori, which yielded 370 deaths from cholera out of 22,695 inhabitants, equal to 16·30 per 1,000. The highest district death-rate, 4·86 per 1,000, was in Balasore, in Orissa division. The total cholera death-rate of the year was made up not so much by severe local outbreaks, as by the wide area within which the disease showed its presence by a few cases. Thus out of 674 circles of registration cholera deaths were registered in 594, or an average of 133 deaths to each circle, but in these 674 circles there are 200,321 villages and towns, and of this great number of population centres all the cholera deaths were returned from 15,581 villages and towns, or a little over 7·7 per cent. of the number.

6. The following was the monthly distribution of the epidemic:—

Months.	Cholera Deaths.	Months.	Cholera Deaths.
January	3,999	July	6,753
February	2,616	August	7,155
March	7,119	September	2,409
April	38,434	October	2,731
May	10,888	November	3,674
June	5,824	December	8,158

These monthly numbers of course are merely averages; for the periods of attack and cessation of the decease differed considerably in different districts. It is certain, however, that the highest death-rates were yielded by the months of April and May.

7. It is not easy to trace any connection between cholera mortality and meteorological elements, as these latter are only available for comparatively limited areas. We shall adduce them, however, under the head of "fever," and show their relation to cholera at the same time. The general result was that dry months accompanied and preceded increase of cholera, and that cholera deaths declined after heavy rain.

8. But the chief agents in augmenting cholera mortality were local causes of the operation of which the following illustrations may be introduced:—

In a violent outbreak of the disease in the town of Burdwan, it was noticed "that those who drew "their drinking water from the River Banka, a sluggish and filthy stream some 30 feet wide, into "which several sewers open, and the banks of which are in some parts largely used for the purposes "of nature, suffered the most."

The next illustration bears on the influence of pilgrims. The town of Ranigange, in which cholera usually occasions great annual havoc, escaped in 1881, a result attributed to the pilgrims "not being allowed to enter it, and to the few who did so being induced to make a short stay." A question which suggests itself is whether the result was due to absence of "contagion," or to absence of crowding and its filthy accompaniments.

Here is another illustration of the same kind. "At Bankura cholera suddenly increases in July, "when pilgrims from Juggernath pass through it, and that all the large and crowded places on the "pilgrim route are first invaded by this disease. As this happens year by year the Civil Surgeon "infers that the disease is introduced by pilgrims, and he suggests that, to establish this fact, halting "places for them be provided, and their haltage be regulated, which if found insufficient to check "cholera will at any rate provide better sanitation for them."

This, were it practicable, would amount to an additional step in the sanitary regulation of pilgrim routes, a subject we have often dealt with. The facts stated regarding Ranigunge appear to show that, on the supposition that cholera is introduced into towns as a "contagion," the few who entered the town ought to have introduced it, but they did not do so. On the other hand the experience at Bankura and other large towns entered by pilgrims, shows that crowding into the towns of persons subject to the conditions in which pilgrims travel may become a very potent cause of cholera in a district where an epidemic is always more or less active. The escape of Ranigunge, not from total absence of the pilgrim element, but from the absence of crowding and its concomitants, is proof of the same law of cholera. It is not necessary to set up quarantine, but it is necessary to prevent crowding of populous towns by predisposed people. It is not in introducing cholera, but in introducing themselves in large numbers among population groups, all of which are living on the border line between health, such as it is, and epidemics, that pilgrims are disease causes. But the Civil

Surgeon in Nuddea shows that the dangers of pilgrim overcrowding may be materially enhanced by local sanitary defects. He says that "the disease appears generally in places on the high road of "either land or water communication, and invariably during the pilgrim season, continuing longer "and causing a higher mortality in those towns and villages where the water-supply is impure and "scanty, and the sanitary conditions most pernicious, especially when the excreta of the sick is "thrown about, the dead burned near, or thrown into the sources of water-supply, and the infected "clothing washed in the same."

Take another case where the pilgrim element was not present. "It was observed that the disease "attacked with the greatest fatality the overcrowded and ill-ventilated localities of the town of "Howrah, which suffered more than any other place." Its death-rate was 5 per 1,000, without pilgrims.

The case of Poori itself, the great pilgrim centre, illustrates the entire pilgrim case better, perhaps, than any other town. In times past it has exhibited an instance of a town of 23,000 inhabitants, liable to periodical influx of pilgrims, not only without any sanitary care bestowed on its residents, but presenting to the crowds of pilgrims arriving almost every conceivable exciting cause of outbursts of cholera. These outbursts require predisposition, which the pilgrims bring with them, and which those of them who do not die of epidemics at Poori necessarily carry away with, them greatly augmented by the insanitary conditions of the place to swell the epidemic mortality by overcrowding, and added filth at places where they stay on their way to their homes. The Sanitary Commissioner states in regard to Poori that the cholera of 1881 "exhibited the same peculiarity in its incidence as "in the previous year, viz., that it increased in activity at three different periods coincident with the "influx of pilgrims to the Poori town, and that it spread generally in the district with their "dispersion." On comparing the death-rate from cholera in Poori with the adjacent district rates the magistrate estimates "that the pilgrims cause a full half of the deaths from cholera occurring in the district among the residents."

The death-rate from all causes in Poori town in 1881 was no less than 95·65 per 1,000, and the previous five years' average was 55·58 per 1,000. Now if all the cholera deaths in 1881 were struck out there would remain 79·35 per 1,000 deaths, towards which, on the cholera pilgrim theory, the pilgrims could not have contributed. This enormous rate of 95·65 per 1,000 was made up as follows:—

	Death-rates per 1,000.
Cholera - - - - - -	16·30
Small-pox - - - - - -	17·53
Fevers - - - - - -	23·57
Bowel complaints - - - - -	21·19
All others - - - - - -	17·04

It will be evident that in 1881 the least fatal epidemic in Poori was cholera, and yet in dealing with the pilgrim question, it is usually the practice to leave all other epidemic diseases out of account, and as a natural consequence, pilgrim deaths on their routes are assigned to cholera.

There can be little doubt, we believe, that the entire epidemic mortality in this abstract must be traced to local and personal conditions to which residents at Poori are exposed, as well as to the influence of pilgrim crowding, but the crowding is apparently an important factor in the nature and extent of disease and death causes. There is, however, no reason why this result should be applied only in the case of Poori. As we have long contended, the pilgrim element is only one of those which lead to augmented mortality. It is nothing more than the element of overcrowding and increase of filth, added to already existing disease elements in these foul towns, and it would be contrary to all experience if augmented epidemic death-rates did not result. A glance at the epidemic death-rates in Poori given above almost raises the question as to whether the more obvious and rapid death cause, namely, cholera, by being so exclusively dwelt on has not been a means of turning the attention of sanitary improvers away from far more important death causes.

Here is a fact bearing directly on this question. "At Bankurá 104 deaths occurred among "pilgrims *en route* for Juggernath, viz., 9 from cholera, 27 from fever, 59 from diarrhœa, 8 from "dysentery, and one from some other cause. Of these 36 died in hospital, 60 on the road, 1 in a "lodging house, and 7 in villages."

9. There are not many examples in Bengal where reduction of cholera mortality can be traced to sanitary measures, but the following cases may be noticed as hopeful.

The town of Decca, with a population of 69,212, had 85 deaths from cholera, equal to a death-rate of 1·22 per 1,000, while in other towns in the same division the rates were 3·11 and 7·24 per 1,000. For several years Dacca has had an improved water-supply which has been laid on to three fifths of the inhabitants.

Calcutta municipal and suburban show the same contrast as regards the prevalence of cholera as they have done in recent years. Municipal Calcutta has been main drained and supplied with pure water, and is, besides, undergoing general improvements, although very much remains to be done in the matter of foul water tanks and bustees; while suburban Calcutta, with its population of 257,149, remains in a condition similar to that of municipal Calcutta in the old time.

The cholera death-rate in municipal Calcutta was 3·9 (above the average), but the cholera death-rate in the suburban division was 7·4 per 1,000.

10. The influence of local topography on cholera mortality may be illustrated as follows:—In the Bhola sudivision in Backergunge, the disease prevailed the least. "The land here is the highest, "and water accumulates and stagnates to a less extent in it than in the remainder of the district. At "Monghyr, the Jumalpore town suffered the most, representing a death-rate of 7·84 per 1,000 of "population. This is a low-lying town at the foot of the hills, and during the rains the water rises "to as near as two feet from the surface. Its surface drains are very filthy, and its wells more or "less polluted."

Among examples of reduced cholera mortality from sanitary improvement should perhaps have been mentioned the case of Durbhanga town, with 47,450 inhabitants, which lost only two people from cholera in 1881. "It is reported that by the great fires that occurred in Durbhanga town it "underwent a sweeping purification." The district death-rate was 0·15 and the town death-rate ·04 per 1,000 from cholera in 1881.

Bengal fairs under sanitary supervision enjoyed the usual immunity from cholera. The Sanitary Commissioner says that "as in the past two or three years, so in this, no serious disease occurred at "any of the fairs; the few insignificant outbreaks that did take place are not worth recording."

Experience obtained in 1881 confirms, but does not add to that of former years of cholera history. It shows the erratic nature of cholera distribution over a great region of India, and its presence in far greater intensity in some regions than in others, without any assignable cause. The intensity of the disease in localities was as usual influenced by local causes, certain of them connected with local topography, but, in the great majority of cases cholera being over the district, it swooped down wherever its presence was courted by insanitary local conditions; and experience of the results attending the removal of these conditions in well-defined instances is hopeful for future progress in improvements.

11. Facts in the present and preceding reports appear to show that the pilgrim question should be dealt with on broader grounds than cholera prevalence among them. This single epidemic disease affords the least reason for interfering with pilgrimages, because by far the largest mortality from preventible epidemic diseases among pilgrims *en route* and even at Poori, the great pilgrimage centre, has been shown in the present report not to be due to cholera. The percentages of 104 deaths among pilgrims going to Juggernath, and at Poori, their destination, was as follows:—

—	Pilgrims.	On Total Mortality, Poori.	Percentage of Epidemic Mortality, Poori.
Cholera	8·65	17·0	20·1
Fevers	26·00	24·6	21·2
Bowel complaints	64·3	22·1	26·2

There is one consolatory fact to place alongside these figures, and this is that the same sanitary measures which will lessen liability to fevers and bowel complaints will diminish the risks of cholera; but if the facts be looked at solely from the side of cholera, and any of the numerous theories about it be relied on for guidance, we may rest assured that death causes among pilgrims and at places of pilgrimage will be left to operate just as if there were no disease theories at all.

12. *Small-pox.*—As already stated the registered deaths from small-pox in Bengal amounted to 24,371, or a death-rate of 0·40 per 1,000. Deaths from it were registered in 423 out of 647 registration circles, but in only 8,759 villages out of 200,321. Of the total mortality 72·04 per cent. took place in children under 12 years of age.

The highest small-pox death-rate of the year took place at the great pilgrimage centre, Poori; as already stated it was 17·53 per 1,000. The rural circle Gope in Poori also gave the highest death-rate from this disease of any rural circle. It was 15·70 per 1,000. The facts suggest the question whether the Juggernath pilgrimage had anything to do with these high local rates. The lowest town ratio was 1·98 per 1,000 at Bhagulpore, and the lowest rural circle ratio was 1·91 per 1,000 at Bustah in Balasore. The year's epidemic appears to have been made up of limited local outbreaks, to which 52 towns out of 96 contributed 1,461 deaths. Out of 44 districts, one only escaped the disease, and the others furnished 22,910 deaths.

Its monthly prevalence for the whole province is shown in this abstract.

Months.	Small-pox Death.	Months.	Small-pox Deaths.
January	2,592	July	1,179
February	4,000	August	711
March	4,490	September	492
April	4,357	October	369
May	3,132	November	433
June	1,879	December	736

The epidemic appears to have passed over from December 1880, and it was most fatal in the dry and warm months.

13. The following was the vaccination staff during the official year, 1881–82 :—

Superintendents	8
Deputy superintendents	11
Native "	10
Inspectors	55
Head vaccinators	24
Vaccinators	379
Apprentices	73
Licensed vaccinators	739
Total staff	1,299

The total number of vaccination operations performed was 1,349,607, of which 11,976 were "secondary." The total number of successful primary vaccinations exclusive of those in the metropolitan area was 1,316,198
and of "secondary" 5,179

Total successful 1,321,377

Of these total successful primary vaccinations, 11·41 per cent. were under one year of age, 63·13 per cent. were of one year and under six years of age, and 25·44 per cent. were above six years.

There was apparently a good year's work done. Estimated on the best available data the birth-rate of the year was 25·51 per 1,000. If taken over the whole population of Bengal the vaccinations would be under 2 per cent., but taken on the calculated births, the vaccinations would fall short by about 400,000. The data are, however, uncertain, and the work is very great. A table in the Report appears to show that in the population under vaccination the births ought to be about 1,319,716, but of this number under one year of age, 1,062,686 remained unprotected. The vaccinators have not yet succeeded in reaching the most effective ages for their work.

14. A fact or two may here be quoted to show how much epidemic constitution appears to be related to small-pox prevalence.

In Midnapore, "in the Contai thanna, where innoculation is practised, while 1,282 deaths from small-pox occurred in 1880, not one death was recorded in 1881." For some cause or other small-pox inoculation was powerless in the latter year to induce the disease.

In regard to small-pox in Noakhalli district, "the Assistant Surgeon refers the outbreak to inoculation." Apparently something was absent in the Contai example which was present in the same year in Noakhalli. The only reference to local conditions as influencing small-pox prevalence is made by the magistrate about Roghunathpore, who remarks that "the town is a labyrinth of narrow crooked lanes, and that it is no wonder that the disease, when it has once gained a footing, hangs about the place."

15. *Fevers.*—There were registered under this designation no fewer than 940,911 deaths in 1881. This is the largest fever mortality yet returned, but the registration of deaths has been undergoing improvement, and no doubt part of the somewhat alarming increase of fever mortality is due to this circumstance.

The annual death-rates from fevers have stood as follows for the last six years :—

Years.	Registered Fever Deaths per 1,000 of Population.
1876	6·14
1876	9·36
1877	11·85
1878	12·38
1879	10·37
1880	11·51
1881	15·71

The earlier ratios in this abstract are obviously due to incorrect registration, and it is doubtful whether the high ratio of 1881 includes all the fever deaths.

The lowest fever-rate of the year was registered in the district of Mymensing, namely, 5·97 per 1,000. From this point the mortality rises in districts and groups of districts to 6, 7, 8, 9, 10, 11, 12, 13, 14, and so on to 27·43 per 1,000 in Murshidabad. The highest rate of the year was in Nuddea, namely, 39·72 per 1,000.

The comparative death-rates in town and country registration circles were :—

	Fever Deaths per 1,000.
Towns	18·84
Country	15·58

showing an excess of 3¼ per 1,000 deaths in the towns; but on the other hand this may be partly due to better registration within town circles.

16. In the next abstract the monthly deaths from fever and cholera in 1881 are shown alongside the monthly climatic elements, but as these latter vary considerably in different regions of Bengal, the means of comparison are only of a general kind. Barometric data are omitted.

Months, 1881.	Deaths from Fever.	Deaths from Cholera.	Rainfall.		Mean Temperature.		Humidity.
			Of Year 1881.	Differences on Average.	Of Year. 1881.	Differences on Average.	
			In.	In.	°	°	
January	85,845	3,999	0·04	−0·50	62·3	−1·2	62
February	69,674	2,616	0·06	−0·88	65·3	+1·1	60
March	64,453	7,119	2·88	+1·64	74·4	−1·9	59
April	73,649	18,434	1·48	−0·85	77·6	+1·3	61
May	66,216	10,833	6·41	+1·27	82·8	−0·7	72
June	51,191	5,842	13·44	+1·30	81·7	−1·4	82
July	60,174	6,763	12·56	−0·28	81·4	+0·4	84
August	66,824	7,155	14·47	+1·38	81·0	−0·2	86
September	72,487	2,409	10·87	+ ·84	81·2	equal	84
October	100,321	2,711	4·10	−0·53	78·5	+0·2	75
November	113,486	3,674	0·07	−0·41	71·0	−0·4	61
December	141,644	8,253	0·13	−0·05	64·1	+0·1	66
Annual	940,911	79,180	67·51	+2·33	75·1	−1·1	71

Taken generally, these data appear to show that low temperature, absence of rain, and dryness raised the fever death-rate in January and December, while they also raised the death-rate from cholera. The fever mortality was low when the air was dry. It continued low till the ground had received most of the year's rain, when the temperature was high and also the moisture, but when rain almost ceased, with falling temperature, dryness, and evaporation, fever attained its maximum. On the other hand, absence of rain, dryness and evaporation co-existed with maximum cholera mortality, which, however, fell immediately under the influence of cumulative rainfall and decrease of evaporation, but it again sensibly rose with decrease of rainfall and of temperature, and increase of evaporation.

With reference to fever causation, the relative climatic and mortality columns confirm what has been long observed in India, that the period of super-saturation of the ground with water-logging, followed by drying up and falling temperature, is the time of most active disengagement of the fever cause.

17. Excess of rain notably lessens cholera mortality, and some time ago we suggested, as a matter for inquiry, whether excess of rain did not operate in the causation, by improving the purity of all water sources. The object in view was, as far as possible, to analyse the compound facts, and to gain knowledge and experience to enable the predisposing causes of cholera to be more certainly grappled with. In the present report is given the result of a number of examinations of water samples made by the Civil Surgeon at Dacca district, but they can only be considered as tentative. Much more must be done before the question is decided either in one way or another; in the meantime we may quote the Sanitary Commissioner's summing up of results. He says,—"The general conclusion on "the influence of rainfall on limited water-supply such as that of wells and tanks is that the water, "notwithstanding dilution, is unfit for use." This conclusion, if confirmed, would nevertheless show that some extent of purification might have taken place. Perhaps the best way to arrive at a practical conclusion would be to select a few wells and tanks here and there, to analyse the water at the end of the dry season and again in the middle or towards the end of the rains, and to place the results side by side in columns such as are usually employed in tabulating water analysis. We may recall the statement made in a former Bengal report, that, whatever might be the injurious effect of heavy rain, followed by water-logging of the subsoil, the rain introduced an element of improved health, by washing out and cleansing tanks and by replenishing wells. The question is a very important one, and might be settled in districts close to Calcutta.

18. But to recur to the fever death-rates. These were returned from all the 674 registration circles in Bengal. Out of 200,321 villages, fever deaths were returned from 141,976, but, considering the universal prevalence of fever causes, as indicated by the fact that every registration circle suffered, it appears doubtful if any village escaped attacks of the disease, at least.

In a former memorandum, we drew attention to the presence in statistics of fever mortality of a tendency towards a cyclical law of prevalence of fevers in the North-West Provinces. The Sanitary Commissioner for Bengal has dealt briefly with the questions in the present report, and has introduced a table showing the fever mortality in each of the divisions of Bengal, Orissa, and Chota Nagpore for the last 11 years; but they all lead to one result, namely, that the fever death-rate is increased generally by improved registration. Until a fair average record of mortality and its causes has been made available, there can be no basis on which to rest a classification of events, and, while registration is being improved, local meteorology would have to be rendered more trustworthy than it is at present, that is, its facts should be given locally, rather than generally for the whole country. One most important element in the discussion could be easily supplied in future reports, namely, the average monthly thermometric range for different districts.

19. The following facts given by the Sanitary Commissioner are sufficient to show the importance of recording more especially the leading meteorological elements:—

The excess of rainfall for the year was 2·33 inches, "but," in the Burdwan division, "there was "an average excess of about 8 inches." The average fever mortality in Burdwan district is about 17 per 1,000, while, in 1880, with augmented rain, it was 23·65 per 1,000. In Midnapore, "the excess averaged nearly 20 inches," while the tables show that the usual fever death-rate, about 10 per 1,000, was raised to 17 per 1,000.

The 24-Pergunnahs had an excess of rain of about 10 inches, together with a registered fever death-rate of 16·18 per 1,000, against a previous five years' average of 14·48 per 1,000.

In Patna district, the excess was 10 inches, and the fever mortality of 1881 was 21·42 per 1,000; the previous five years' average having been 12·30 per 1,000.

But it does not follow that decrease of rain should be attended by decrease of fever, the fever cause may still be sufficient, under certain local and topographical conditions, to generate malaria under the influence of temperature and atmospheric moisture. The report furnishes examples of this relation among the climatic elements, and it follows that, in fever etiology as in all other similar questions, it would be unsafe to attribute the complex phenomena, which together make up a case of what is called zymotic disease to any one cause.

For example, in Mymensing district, in Dacca division, there was an average deficit of rain of nine inches, with a fever death-rate of 5·97 per 1,000, which was slightly in excess of the five years' average, viz. 5·86 per 1,000. In Rajshahye and Cooch Behar division the rain deficiency was four inches. The division contains eight districts, in six of which the fever death-rate was augmented above, and in two diminished below, the average rate.

20. But, besides climatic elements bearing more or less directly on predisposition to fever, the report under review contains much important information regarding local fever causes.

In Burdwan a large proportion of fever deaths was attributed by the civil surgeon to pneumonia, "induced by damp houses and insufficient clothing." In one thana in Ranigunge nearly 90 per cent. of the people were attacked along the low-lying banks of the Damuda river. By the end of the month of October "drying up of swamps and stagnant pools was at its height, and it was at this time "and in November and December that the fever was most severe."

In Bankura "the severely affected localities were reported to be the most crowded parts of the "districts, abounding in all the insanitary conditions favourable to the progress of fevers." In the most severely affected villages the magistrates found "a disproportionately large number of foul tanks "and a great deal of decomposed vegetation in them, making the water most unwholesome." In the same district the civil surgeon states that "growing insanitation," connected with increase of population, "are the special features of the country seriously affected by the disease." And in enunciating this view he has touched on a law of epidemics which is too apt to be overlooked when single or specific disease causes are held as ground of sanitary work. The law is, that when there is an established ratio of increase of population in any town, village, or district there must be a corresponding increase of activity in all sanitary procedure, because otherwise increase of population would imply increase of local disease causes, until a point is reached when further increase of population would involve degradation of type, and then the epidemic comes in to sweep away the surplus population, and matters again revert to their previous position. It is in this sense that epidemics are conservative at the expense of lives of people who ignore the conditions on which their tenure of life is held. In the case cited by the civil surgeon overcrowding and sanitary neglect go hand in hand, but increasing sanitary neglect without overcrowding leads to the same result, and in such cases too much or too little rain, abnormal temperatures and moisture, dimunition of food supplies, may let loose the epidemic which will claim its victims as long as any susceptible subjects are left.

On the general influence of insanitary conditions in augmenting fever mortality, it will be sufficient to cite the case of Nuddea district. Fever statistics are given for all the 35 circles in this district, the general result of which is that the ratio of deaths from fever for five years, 1875–79, was 13·87 per 1,000. In 1880 the rate had risen to 29·98 per 1,000, while in 1881 it had reached the enormous proportion of 36·27 per 1,000. In one of the circles, Kaligunge, the fever death-rate, which had been 15·24 per 1,000 in the years 1875–79, rose in 1880 to 34·64, and 1881 to 69·40 per 1,000. It need scarcely be said that increase of rain would hardly account for this enormous mortality. There must have been some agency through which the rainfall and temperature acted. Of the nature of this agency the following account is given. The aggravating causes were "effluvia arising "from cesspits, fæcal polluted lands, decaying vegitation, and impure water. . . . During the "past few years a gradual silting up of the small streams and their tributaries has been taking place "thus these running streams become stagnant pools and hotbeds of pestilence in the dry season. ". . . Again, the bunding of rivers, particularly in Chuadanga, to protect rice cultivation has "done a great deal of mischief by confining the annual floods within the river beds. The effect of "this ill-judged proceeding is to prevent the natural water flow from cleansing out tanks and other "water sources, and to interfere with natural subsoil water movement. From this cause the "mortality was excessively high in some villages, several families having been completely cut off, "and there is scarcely a house that has not suffered."

There are several other examples of the evil influence of interfering with the natural course of floods by embanking, and we are glad to learn that Government had taken up the subject, and appointed a Commission to investigate the facts, and introduce remedial measures as far as practicable. The report of this Commission had not been made public, and we must wait for it; but it may not be out of place, as part of the year's disease history, to introduce the following points:—In certain villages in Nuddea "the people ascribe their unhealthiness to the insufficient rise of the river, for "the past two years, which did not overflow the embankment, and wash out the villages effectually." In certain circles "the inhabitants themselves attribute the fever to drainage being obstructed by "Government embankments." A thana in Serampore suffered severely, and "the direct cause of

" the severe prevalence of the disease is referred to the Damuda embankment, just outside, which " prevents the washing out of the pits and tanks." In regard to this place it is further stated that " Mr. Carstairs, the sub-divisional officer, appointed a punchayet at Rajbulhat, who worked hard to " get the drinking water tanks properly cleaned, to have the jungle around the tanks and pits " properly cleaned, and to provide good drainage. . . . It is observed that the prevalence of " the disease in this place has since stopped." The punchayet, it will be observed, had done the work of a flood, and although one such case cannot establish a practical rule, it shows that what one official has done could be done by others.

21. The influence of embankments for roads and railways on the amount of fever has often been discussed. In the present report the civil surgeon of Birbhum states that, with boundaries defined by railway lines before us " nothing can be easier to jump to the conclusion that fever and railroads " are intimately associated with each other as cause and effect." He doubts the conclusion, however, and says very properly that "we must wait for further information." The countervailing considerations he mentions, such as the absence of excess of fever in other years in the same districts, want of direct proof of causation, &c., are no objections to the general principle he has stated; but we must wait the result of official inquiry.

22. One important practical result may, however, be considered as already arrived at, and this is that whatever allowance may be made for climatic influences, and these are undoubtedly of great importance, and whatever may be the result of over-irrigation, silting up of water outlets, and water-logging of subsoils, there is a whole class of fever causes which can be at once grappled with, and chief amongst these are village and household filth and foul drinking water. Let immediate steps be taken to cleanse and keep clean villages and houses, to cleanse out foul water tanks and wells, and to protect them from pollution, and we may rest assured that a considerable amount of the great fever mortality will cease. Atmospheric causes may influence the number of fever attacks, but the extent to which these attacks may prove fatal is mainly dependent on purely terrestrial and local conditions over which we have control. We can cleanse and keep clean our dwellings and surroundings, we can protect water sources from impurity, we can keep the drainages of the country open, and we can relieve water-logged subsoils by drainage; we can so construct even the humblest dwelling as to avoid damp floors and damp walls without cost, and people who at present sleep on damp floors may be induced to raise their beds in some way above its level.

If these things be done, and suitable provision for keeping cattle in their proper place be made, other things are sure to follow, such as better working power and better means for providing against atmospheric changes by food and clothing, and as a necessary result there will be a great reduction of fever and general epidemic mortality.

In India as elsewhere, the great physiological law must be recognized and acted on, that, in whatever climate we live, it is an imperative part of every day duty to adapt our habitations and personal living to its requirements. The danger lies in ourselves, not in the climate.

23. *Bowel complaints.*—The following abstract shows the monthly prevalence of these diseases in 1881:—

Months.	Bowel Complaint Deaths.	Months.	Bowel Complaint Deaths.
January	4,265	July	4,666
February	4,514	August	5,023
March	4,383	September	4,720
April	5,345	October	4,367
May	4,893	November	5,008
June	3,560	December	5,585

The total deaths from bowel complaints, chiefly diarrhœa and dysentery, were 57,029, equal to a death-rate of 0·95 per 1,000 on the registered population. These deaths were extensively prevalent, and were registered in the 674 circles, with 24 exceptions, but only 23,250 villages, out of 200,321, returned deaths. The facts show that there is still considerable uncertainty in the registration.

The lowest circle death-rate was 3·51 per 1,000 in Bankipore, in Patna district, the highest was registered in Busta circle, in Balasore, namely, 8·79 per 1,000. Of towns, Poori had the highest bowel complaint death-rate, 21·19 per 1,000, a ratio which exceeded the cholera death-rate in the same town, viz., 16·30 per 1,000. The highest registered death-rate of the year from cholera and bowel complaints both took place in the same pilgrimage town, a fact apparently showing some connexion either between the diseases or their causes. The rainy and cold months in this, as in previous years, yielded the highest bowel complaint mortality, showing the evil influence of surface chills, connected with deficient shelter and clothing (amongst other things), on the amount of bowel diseases.

24. *Injuries.*—Under this head are included 2,428 suicides, 1,274 deaths from wounds, 8,451 accidental deaths, and 9,502 deaths from snake-bites and wild beasts. The last item is the largest in the account, and shows clearly the great need of affording increased protection to the people from this death cause.

25. *Other Diseases.*—Not much can be said of this heading, except that the causes of 132,332 deaths, equal to a death-rate of 2·21 per 1,000 of the population, cannot yet be classified, and it is too early in the progress of Indian registration to expect that they should be so.

26. Before concluding this account of the disease history of 1881, we shall notice briefly the facts of cantonment and port of Calcutta death-rates.

Cantonments.—Returns from 12 cantonments in Bengal give 699 deaths out of an average aggregate population of 34,063, or 20·52 per 1,000, or 3·20 above the ratio of 1880. Of the year's death-rate fevers yielded 12·68 per 1,000, cholera, 1·17 per 1,000, and bowel complaints, 1·14 per 1,000. Deaths ought to be more correctly classified within cantonments than among the general civil population, and, if this be so, we have a high fever death-rate among a population which ought to be under practicable sanitary control.

27. *Port of Calcutta.*—In 1881 this port was visited by 16,672 seamen, of whom 14,328 were Europeans and 2,344 natives. But the average port population of 1881, as determined by the same year's census, was 2,791, or about one fifth of the entries, which would perhaps afford a safe method of estimating the population for statistical purposes in the absence of a census enumeration. The following abstract gives the total admissions and deaths from among the entries for 1881 :—

Diseases.	Admissions.	Deaths.	Deaths per 1,000.	
			On Numbers visiting the Port.	On the Port Population.
Cholera	54	34	2·37	12·1
Diarrhœa	116	3	0·17	1·07
Dysentery	107	4	0·23	1·43
Fevers, Enteric	7	4	0·23	1·43
„ Malarial	186	4	—	1·43
„ Simple	197	—	—	—
Sunstroke	9	3	0·20	1·07
Scurvy	20	1	0·05	0·36
Others	1,112	19	1·38	7·00
Total	1,799	72	5·02	25·80

This includes all the deaths in and out of hospital. Of the former there were 65, and of the latter 7,—72 in all. The facts have an important bearing on the question of quarantine, for these European seamen entered an area within which the following casualties took place among a native floating population of 25,409 :—

Diseases.	Deaths.	Deaths per 1,000.
Cholera	70	2·75
Dysentery	3	0·12
Malarial fever	33	1·30
Scurvy	1	0·04
Small-pox	2	0·08
Others	32	—
Total	141	5·54

But, besides these deaths on board native vessels, there were 321 admissions to hospital and 52 deaths from among the same population, so that to make the ratios correspond with those for European sailors, both classes of admissions and deaths must be added together, and hence 25,409 of floating population yielded in 1881 the following deaths :—

Diseases.	Deaths.	Deaths per 1,000.
Cholera	86	3·38
Dysentery	9	0·35
Malarial fevers	35	1·37
Scurvy	1	—
Small-pox	4	0·15
Sunstroke	1	—
Others	57	2·24
Total	193	7·59

These abstracts regarding the native floating population show clearly that many cases and deaths take place which cannot be registered, and hence the facts are not comparable with those regarding the European seamen. They are sufficient, however, for the object we have in view. They show that, among the river population, 86 died of cholera in 1881. The ratio was 3·38 per 1,000. During the same year, the cholera death-rate in municipal Calcutta was 3·9 per 1,000, and in suburban Calcutta 7·4; and into a region where cholera prevailed to this extent there came in the course of the year 14,328 European seamen from the ocean, where there was no cholera, and 51

took cholera, of whom 34 died. The case is one diametrically opposed in its circumstances to the case of healthy ports where quarantine is declared against arrivals from cholera-infected ports, or from ports supposed to be infected. Healthy persons arrive in a cholera-infected port and city, they enter the city, and in doing so come under all the possible risks of local infection, acting on healthy people, and this (be it observed) is perhaps the greatest of all risks that can be incurred when epidemic cholera prevails, and the deaths amount to 2·37 per 1,000 of these arrivals. The essential condition, as has been proved by all experience, is that cholera should be in the locality into which healthy seamen come. Now, let us follow these men on their homeward voyages. First, they leave the cholera port where one man in every 421 who entered it died of cholera. It is another long known fact that the most effectual remedy against cholera attacks is to leave the locality where it exists, and this is precisely what is done; but it sometimes happens that a man already under the influence of cholera is taken ill at sea, while the others escape. In the great majority of cases, however, there is no cholera on board homeward bound ships, and, as all these arrive at ports where there is no cholera, surely there ought to be no fear of importing that which all experience shows is not there to be imported, and which cannot even exist without an epidemic and local favouring conditions. Should we expect healthy men to be attacked on landing in a healthy port? The question answers itself. There is absolutely no ground, either in fact or reason, for placing healthy ships in quarantine. The only possible ground, not for quarantine, but for ordinary sanitary precautions, is where a ship has had cholera on board, because in such a rare case, there may be a presumption that bad management may have led to local causation, for we now know that, without favouring local conditions, there can be no cholera, even in an epidemic region. When an epidemic is moving, all neglected population groups in its course are liable to be attacked, and unwholesome ships among others; but it is known that, even in these days of rapid voyages, the epidemic will, at times, head the ships. Thus, during the moving epidemic of 1865, while steam vessels were plying between Alexandria, where cholera existed, and Malta, and were placed in quarantine when they arrived there, a fatal case of cholera, the first in the island, followed immediately by others, took place in a soldier's child three days before any passenger in quarantine was affected with diarrhœa, and eight days before any case of cholera was "imported" at the lazaretto. The epidemic had travelled faster than the steamships. But the most telling experience was that afforded by the quarantine imposed at Gibraltar and Malta, after the epidemic had covered the west of Europe, rendering all the ports "suspected."

The quarantine authorities at Gibraltar were compelled, for local reasons, to put arrivals from suspected ports in quarantine, and 634 vessels, amounting to 323,409 tons, were dealt with in this way, while at Malta 1,008 vessels, of 502,507 tons, were quarantined. At Malta, two coasters, which had cholera on board coming from Italy, were sent away. Among none of the quarantined vessels at Gibraltar and Malta was there a solitary case of cholera. There were two cases of diarrhœa on board a pilgrim ship at Gibraltar, and eight cases of diarrhœa on board ships in quarantine in Malta, all of which, except one case, took place while cholera was in the garrison.

These facts were published in detail as far back as 1867, and it may not be out of place to reproduce the aggregate results now on account of recent quarantine proceedings against Indian seaports.

28. *Sanitary works (Civil).*—This section of the Sanitary Commissioner's Report is the most important, because of the information contained in it regarding the year's sanitary work.

As already stated, there are in Bengal 34 districts within which improvements are more or less in progress, with a total population, in 1881, of 68,829,926. Within these districts are 182 municipalities, including 96 towns, the population of which, 10 years ago, was 2,855,165, but probably not far from three millions at the present time. The remainder of the district population occupies 200,321 villages within which the real sanitary work has to be done, except works of general drainage and water supply of districts.

The aggregate income of municipalities and unions, in 1881, was 279,120*l.*, which was, for public health purposes, expended as follows :—

	£
Conservancy and latrines	16,976
Conservancy establishment	29,187
Drainage	5,755
Water-supply	2,590
Disposal of dead	558
Markets and slaughter-houses	633
Vaccination	930
Treatment of sick	7,116
Other sanitary works	3,066
Roads	45,199

To the three fundamental sanitary works, cleansing, draining, and water-supply, there was allotted 54,508*l.*, not a very large amount, but still showing, in its apportionment, that cleansing is receiving additional attention, as the expenditure on it exceeded by 10,000*l.* that of 1880.

Some account is given of the works on which outlay was incurred, but their general character will be sufficiently understood from the preceding abstract of expenditure.

Besides these proceedings, important sanitary improvements have been initiated and carried out by district officers, which may be separately noticed.

"In Burdwan, Mr. Caspersz, the sub-divisional officer of Ranigunge, has paid, and is paying, "great attention to village sanitation. His endeavours are directed to having refuse heaps properly

" dealt with, holes and small pools filled up, drinking water tanks reserved and kept clean, drains " cut in village lanes, and the latter levelled, &c. This is done through the villagers, and some " success has attended his action."

At Bankura, Mr. Anderson is continuing his efforts to improve the sanitary state of the people by cleansing water tanks, and improving roads and drainage. " Preservation of tanks for different " purposes is now, he reports, readily attended to by the people, and with very little help from the " authorities." He is preparing the ground for more extended operations in these matters. In Serampore, Mr. Carstairs " generally works through the punchayets in matters relating to sanitation," and in places not having these officials he has appointed sanitary punchayets. He has succeeded in raising large local subscriptions for improving village roads. Increased interest is taken in localities in sanitary work, and in some places they are working for the public good. Such a state of things, he remarks, " is an accomplished fact in more than one populous section outside municipalities in his " division."

In Murshidabad, the magistrate, Mr. Moseley, had been able to prevent river pollution by dead bodies, and fouling the river banks.

Mr. Porch, magistrate in Maldha, has been doing what can be done, with the funds at his disposal, in the way of drainage, clearance of jungle, removal of insanitary surroundings of houses, &c. " He " had much to contend with in the apathy of the people; but he has taught the zemindars and their " ama, and the leading villagers, as far as practicable, the advantages of effectual drainage, and " of careful use of good drinking water, and keeping their houses and their vicinity free from foul " accumulations."

On the other hand the deputy magistrate of the Terai, in Darjiling, is said to have explained all these matters to the leading jotedars " without effect;" a similar result appears to have followed advice given at Shahabad by the magistrate, Mr. Nolan.

Although the proceedings of local magistrates have as yet covered only a small area of country, still it is satisfactory to find that there are cases in which the people have been led to help themselves, and we are glad to learn that native proprietors have in a few cases begun to interest themselves in the sanitary state of their properties.

29. Under the head of *General advance in Sanitation*, the Sanitary Commissioner gives a summary of the year's work done in a large number of towns and other localities in all the Bengal districts. The nature of this work will be sufficiently understood from the detail of expenditure already given, but there is one item in regard to Patna towns of such a character that we may quote the statement, as showing one of the first steps taken in a large town in Bengal, so far as we know, in carrying out one of the most important sanitary improvements. The summary states that, " at Patna, the " Commissioners have agreed to the introduction of the house scavenging system again, steps were " being taken to bring it into effect, and it has been decided to suppress a large number (about " 5,000) of well privies, mohullah by mohullah." A similar decision will have to be taken and carried out within the area inhabitated by nearly every population group in India before the subsoil can begin to recover itself after centuries of pollution. The fact of there being 5,000 of these well privies to be done away with in one town speaks volumes on the local reasons of Indian epidemics of cholera and fever, and their connexion with foul well water, polluted subsoil, and foul atmosphere within and around dwelling-houses.

Considerable improvements in this direction have been already carried out in Dacca town, in which we are told that " well privies were actively suppressed." Two thousand private latrines, to be cleaned by municipal sweepers, had been provided instead of well privies, and the work was still proceeding. Similar work was being done in many other towns.

The question of improved water-supply was also receiving attention.

" The Eden canal project, whereby good water is available for the town of Burdwan, Hughli, and the country through which the canal passes, was completed in December."

The water is to be laid on to Burdwan by pipes. It is in contemplation also to reopen the old Gangoor river in the Burdwan district, by which a large tract of country will be drained and supplied with water. Dacca water supply is to be extended. Schemes for supplying suburban Calcutta with water were under consideration. One had apparently been approved on account of its greater cheapness, but it " seems to be much inferior as a sanitary measure," says the Sanitary Commissioner, and if his view be correct it may safely be predicted that, like other cheap work of the kind, it will cost the ratepayers more than the presumed saving over a thoroughly efficient scheme.

The Govindpore lake in Manbhum has been formed by private subscriptions, and will supply good water to a large population, and to travellers on the Grand Trunk road.

In the Bogra district six water supply tanks had been dug by private subscriptions.

Drainage.—The main drainage channel and its branches in Dinagepore district was completed. It cost 5,734*l.* Drainage works had been completed in other places, and a scheme was under consideration for draining a part of suburban Calcutta. In this district great improvements had been carried out on bustees.

The Government of Bengal appears to have entered thoroughly into the public health question. The Bengal Municipal Act was extended to a number of towns, including the great pilgrim cholera centre Poori. The Act empowering commissioners to regulate public and private latrines had been extended. But perhaps the most important step taken by the Government has been to relieve municipalities, stations, and unions in Bengal of all police charges.

" The effect of these orders," says the Sanitary Commissioner, " will therefore be to give them a " grant of three and a half lacs of rupees per annum." And the intention of this concession is, " that

" this amount shall be expended on sanitation, and other works of improvement, and on education." The great difficulty in sanitary progress, namely, want of funds, " has thus to a material extent been removed." In the course of the year further measures were taken for improving the health of the port of Calcutta by preventing defilement of the river banks. The Sanitary Commissioner sums up the year's work in the following words:—" Generally, fair progress has been made in sanitation, " particularly with regard to drainage, the cleansing of the abominable private privies by the " municipal mehters, instead of by private mehters, and the construction, metalling, and improvement " of roads."

Appended to the report is an abstract of inspections of 28 towns made in 1881, stating briefly under separate heads the defects observed, suggestions made, and the action taken on them by the local authorities. The results have been briefly noticed in the preceding pages.

30. In summing up the results of the report under review, we are desirous of stating that the Sanitary Commissioner has bestowed much pains on it, and has continued his work in the same practical direction as he showed in his report for 1880.

There is still, of course, the great statistical difficulty to deal with, for as the Government of Bengal has observed in its resolution, " In considering the statistics given of the mortality from the principal " diseases, it is necessary to bear in mind that they are not even approximately correct as a whole. " Of the actual mortality throughout the area under registration they give no indication."

Cholera mortality is, perhaps, the least inaccurately reported, as this is a well known death cause among the people.

Any way there is no question that, except in some towns, registration requires almost as much improvement as sanitary condition.

Taking the facts stated by the Sanitary Commissioner, there can be little doubt as to the disease causes which must be dealt with before those epidemic pests are reduced to their lowest practicable level.

There are atmospheric causes which cannot be directly dealt with, which may be considered as predisposing causes of all of them. These are shown, although very imperfectly, in the abstract tables we have given above. But of far greater moment to the public health are terrestrial, local, and personal causes, all of which are more or less under human control. The drainage outlets of areas of country can be improved and kept open, and stagnation of subsoil water can be more or less effectively removed by drainage works.

Foul water sources, whether in tanks, wells, or streams, can be improved and protected, or, if necessary, replaced by others. Water holes and broken ground in and about towns and villages can be filled up, drained and levelled. Towns and villages can be surface drained at small cost, and with great benefit to health. But the great cause which aggravates the severity and fatality of all Indian epidemic and endemic diseases is simply filth. If every town and village in India were cleansed, and kept clean in its open spaces, streets, lanes, and houses and house compounds, and cattle housed away from human dwellings, we should hear little of these epidemic diseases which at present decimate and destroy the working power of the people. This is the sum and substance of the present report.

We would at the same time acknowledge thankfully the good which is being done by the Government and its various officers and agencies in improving the sanitary condition of the vast population entrusted to its care. But there is one subject of regret, and this is, that the present report affords no indication of any work done by the vaccination officers during their numerous village inspections in trying to make the people improve their houses and surroundings, so as to improve their health.

13th June 1883.

No. 5.

Memorandum of the Army Sanitary Commission on the Report of the Sanitary Commissioner for the Punjab for 1881.

1. The population returns obtained on the census of 1881 were not sufficiently classified when the present report was prepared, to be available for the calculation of ratios on the usual forms. There is, however, a district abstract given by the Sanitary Commissioner in which the population under registration, and exclusive of military cantonments is stated at 18,676,032, the births at 695,766, and the deaths at 519,779. The birth-rate of the year was in round numbers 37 per 1,000, and the death-rate 28 per 1,000. Both ratios show a very considerable improvement in registration, for the registered births exceeded the numbers of 1880 by 151,107, and the registered deaths were 47,948 in excess of the preceding year's number. Out of 32 districts, Kohat and Dera Ghazi Khan had the lowest death-rates, namely, 15 per 1,000. The highest district death-rate, 47 per 1,000, was registered in Amritsar, on the causes of which we shall have some important facts to state in the sequel.

2. Registered birth and death-rates were much higher in the municipal towns, and averaged in 52 of the larger towns 41 per 1,000 births, and 48 per 1,000 deaths. By far the greatest loss of life during the year, took place in the town of Amritsar itself; where out of a population of 136,166, there were no fewer than 16,984 deaths, equal to a death-rate of 125 per 1,000.

3. The following were the chief death causes in 1881, but the death ratios are calculated not on the population of that year, but on the preceding census population of 1875–76.

Diseases.	Deaths.	Death-rates per 1,000.
Cholera	5,207	0·30
Small-pox	6,749	0·38
Fevers	355,279	20·72
Bowel complaints	17,281	0·99
Injuries	5,695	0·32
All others	129,568	7·41
All causes	519,779	30·00

The actual registered death-rate on the population of 1881 was 28 per 1,000, and it follows that local rates are somewhat higher than they should be.

We shall give some account of these deaths causes in their order.

4. *Cholera.*—On the 19th September, 1881, the Government of India issued a very important order, appointing the following Committee to inquire into the history of cholera in the Punjab, and also in India generally, including the civil population and troops.—Colonel C. H. Hall, Commissioner, Rawal Pindi; Lieutenant-Colonel Stevens, Rifle Brigade; Major King Harman, D.A.Q.M.G.; Surgeon-Major H. W. Bellew, C.S.I.

The Government issued at the same time a code of instructions stating the points requiring investigation, and reminding the Committee that the object was of a purely practical character. "Mere theoretical discussions," they say, "and quotations from works on cholera are not desired. "Whatever conclusions are advanced should be based on the facts adduced; every such conclusion "should be carefully framed, the evidence which appears opposed to it being weighed and recorded "as fully as evidence in its favour." Recommendations are to follow the report of measures for protecting the public health from cholera in future years. We shall wait the results of this independent practical inquiry with much interest, and in the meantime Mr. Bellew has made the following statement about it:—"The report of the Committee is still under preparation, but all that "need be mentioned here is, that sufficient facts have been accumulated from all parts of India, to "enable us to see more of those conditions which favour the development of cholera in India. The "numerous statements and charts attached to the reports conclusively prove that cholera has its "special laws, which guide and govern its existence and prevalence, and that those laws or conditions "are not identical in all parts of India, but are evidently influenced by the conditions of climate and "locality."

5. We shall next give the facts bearing on cholera prevalence in the Punjab during 1881. In our Memorandum on the Punjab cholera of 1879, printed in the India Office Sanitary Report, Vol. XIII., we gave an abstract of registered cholera deaths in the province for a number of years, to show the periodic character of local cholera epidemics, and we shall here continue it for the last ten years.

Years.	Registered Cholera Deaths.
1872	8,727
1873	148
1874	78
1875	6,246
1876	5,736
1877	29
1878	215
1879	26,135
1880	274
1881	5,207

The figures show irregular undulations in annual intensity. The monthly prevalence of cholera in 1881 was a follows:—

Months.	Cholera Deaths.	Months.	Cholera Deaths.
January	3	July	183
February	4	August	1,649
March	4	September	2,560
April	5	October	545
May	37	November	38
June	179	December	1

This abstract has an important bearing on the relation of Hurdwar pilgrimage to cholera prevalence. The great 12th year's fair takes place in March, and because there is an augmentation

in and after April, it has been usual on cursory examination of the facts to attribute the increase to pilgrims spreading the disease. But the following abstract, showing the total cholera deaths registered month by month since 1867, which was one of the great fair years, and including 1879, which was the next and latest of them, shows that the law of cholera takes its own course irrespective of the great pilgrimages.

Total monthly deaths from cholera in the Punjab for 15 years, 1867 to 1881.

Months.	Total Monthly Deaths.
January	285
February	239
March	460
April	,233
May	18,862
June	17,689
July	15,424
August	20,707
September	16,616
October	7,742
November	1,249
December	263

Of course, some allowance must be made for errors in diagnosis and record, but a period of 15 years diminishes the error, and gives approximately accurate results. As these stand they show that if the pilgrimages were abolished the monthly ratios would remain much as they are now. But this fact would not show that pilgrims going to and returning from the fairs would not suffer themselves, and inflict loss of life on villages if they crowded into them. They prove conclusively, however, that the great annual increase of deaths on and after April is not due to the twelve years' recurring pilgrimage.

6. In our memorandum on the Punjab Report of 1879, we called attention to apparent errors in diagnosis of cases of cholera in the first quarter of the year, and in the Report for 1881 Mr. Bellew again reverts to this matter, and gives the results of inquiry into the genuineness of the first 16 fatal cases reported in the latter year, from which it appears that five cases were cholera, and all the others of other diseases, but several of the deaths took place in a day.

It may be that a coming epidemic of cholera modifies other existing diseases, or it may be that the verification of cases is not always made by competent persons.

Mr. Bellew appears to consider the first diagnosis as likely to be the more accurate than the amended ones. It is a question of probabilities. Wherever the facts have not been verified by a medical officer, we have to trust to the general impressions of the people, but in adopting this principle, we cannot overlook another fact, that it is one applicable to all the deaths of an epidemic, and that the result of it would probably be to increase considerably the registered cholera mortality at the expense of the other statistical headings in the returns. There is no way at present out of this difficulty. It must be remedied by improved diagnosis and more accurate registration. At present the registered facts must be accepted for purposes of comparison.

7. In the abstract already given it will be seen that the 16 fatal cases referred to occurred in the first four months of the year, and that the epidemic really began in the month of May. It attained its maximum in September, and died out in December. Out of 32 districts eight had no deaths registered from cholera. Out of 446 registration circles, all the deaths were returned from 121. But perhaps the most remarkable feature of cholera distribution was afforded by the fact that 5,207 deaths, which made up the epidemic of the year, were registered from only 371 villages out of 34,973. The epidemic showed itself in greatest intensity in Lahore district, where 18 out of 21 registration circles returned cholera deaths. In this district, 116 centres of population out of 1,672 yielded 1,643 deaths.

The city itself had no fewer than 772 cholera deaths, and as the Civil Surgeon attributed the Lahore outbreak to importation from Meean Meer, it may not be out of place to compare the facts adduced in proof of this view with the dates of attack. The first Lahore case given by the Civil Surgeon was in a man who was said to have been taken ill with vomiting and purging on 31st May, and to have died on 1st June. This case, however, is set aside. "On 5th June the disease broke "out in the cantonment at Meean Meer," and on the 6th two young men went from Lahore to Meean Meer to see a friend who had been seized. They returned to Lahore, and were both attacked the same night, and one of them died, and then other cases are connected with these, and the Civil Surgeon says "that it is impossible, therefore, not to conclude that the disease was "imported in the first place from Meean Meer, and spread therefrom." The relation of all the facts to each other could only be discovered by careful inquiry on the spot, and we have no means of testing the validity of the Civil Surgeon's view except by reference to dates in the present Report. He gives the date of the first imported fatal case as 5th–6th June. The Report gives the first fatal Lahore case as 6th March, and the first case of which the date is given by the Civil Surgeon died on 1st June, before the disease appeared in Meean Meer.

The following important practical remarks are made by the Civil Surgeon, Jullundur, on the subject of cholera quarantines:—"In the breaking out of cholera in a city quarantine seems to be "the first dread in the eyes of the people, and their sole motive for concealment, because as soon as

" it became known we were going to do nothing of the kind, and intended to bring medicines to " their doors, they willingly gave us information. Now that the epidemic is over, their gratitude " was unbounded in that they were not dragged from their houses to be put into a quarantine " hospital."

The Government of India have had recent troubles about quarantines against cholera, and cholera quarantines have been condemned in India by special inquiries. It may be suggested whether it would not be advisable simply to put an end to them. Anywhere, except in the few special cases where treatment cannot be effectually given in the patient's house, forcible removal should be everywhere abolished. The only real quarantine measure is one that every person must adopt for himself, namely, not to spend time in a locality where any epidemic outbreak has taken place longer than he can avoid. All else is sheer waste.

8. In the present Report Mr. Bellew has given a very complete account of the cholera of 1881 in its sanitary aspects, and hence this Report forms an important contribution to the sanitary history of the Punjab.

The epidemic nature of cholera is evinced by its distribution. It was much more intense in some regions of the country than in others, showing itself in greatest force in districts continuous with those of the North-West Provinces, while the western districts of the Punjab comparatively escaped the disease.

The influence of locality was clearly shown, and also the augmented severity of the disease due to local sanitary defects, bad water, and the like, errors in diet, unwholesome diet and fasting.

The following facts regarding the sanitary state of affected houses in Phillour are given by the Civil Surgeon :—" It was a harrowing sight to visit the low quarters of the town, such as Ali " Mahalla, or treading one's way in and out of narrow passages and fearfully crowded dwellings, as " in the Killa, often black and cobwebby, perhaps roof falling in and a running stream of rain " drainage under the charpoys the patients were sleeping on. The scenes were calculated to terrify, " when partly from desertion and chiefly from death it was as though one were in a city of the " dead, the stillness only broken by the wailing of the mourners." In districts such as this, of which there are many all over India, there is but one available remedy when an epidemic is in the air, and this is removing the people, but it must not be forgotten that one main end of sanitary work is to root out such deadly localities wherever they exist. The present report shows that running away from infected villages into the jungle is a ready means of escaping from cholera, and it shows what the practice should lead to in special localities.

In 1879, the pilgrimage year, there were 88 cholera deaths in Jullundur, and the outbreak was attributed to the advent of pilgrims. There were no pilgrims in 1881, and "there was a regular " explosion in the city." In August and September 421 persons died out of a population of 35,222, and 172 in the suburbs, out of a population of 15,702. The very unfavourable position of Jullundur, in regard to drainage and general sanitary arrangements, is well known, and the report states that " the wretched state of rain and damp that prevailed in the mud dwellings in which very many of the " cholera cases occurred would hardly be believed." The rainfall in July and August was 23·48 inches, of which 6·86 inches fell on one day. " The air was laden with moisture and teeming with " life all round the city. The Civil Surgeon says, we were water-logged by large accumulations " of storm drainage."

The real remedy in such a case as this can only be applied by a skilled engineer.

9. The city of Amritsar suffered greatly in 1881 from two epidemics of fever and cholera which overlapped each other, and in numerous cases the two diseases were so confounded together, that it was difficult to distinguish the one from the other.

The following abstract supplied by the Sanitary Commissioner gives the monthly deaths registered in the city from each disease in 1881 :—

Months.	Cholera.	Fever.	Months.	Cholera.	Fever.
January	—	209	July	—	171
February	—	154	August	45	286
March	1	170	September	328	2,652
April	1	189	October	225	4,279
May	—	193	November	8	2,540
June	1	231	December	—	950

A somewhat similar concurrence of two epidemics took place in Amritsar in 1869, but in that year the mortality from cholera was five times greater than in 1881, while the fever mortality was not much less than threefold in 1881 what it was in 1869.

The fever in 1881 appeared to be relapsing fever, "but with some affinity to cholera, and the two " diseases masked one another so effectually that diagnosis was extremely difficult at times." The history of such cases is given as follows :—" Fearfully severe headache, insomnia, disordered bowels " (often constipated), suppression of urine, and death by coma, frequently within a few hours after " seizure of relapsing fever, but then the rice water evacuations and vomit of cholera appeared in " very many instances during the course of the attack of fever. . . . . In not one but 50 to " 100 cases was the *materies morbi* (of the two diseases) observed to be operating in the same " individual at the same time." Such attacks went by the name of cholera fever, and appear to have been confined to the interior of Amritsar, while malarious fever prevailed outside. We shall return to this subject while discussing the fever section of Mr. Bellew's Report, but it may be here stated

that the predisposing local causes appear to have been excessive rainfall without adequate drainage outlets. The whole subsoil of city and suburbs was water-logged, so that the subsoil water rose in springs above the surface, leading to disturbance of filth in the subsoil of the city and pollution of wells.

Concurrence of cholera with fever in the same localities and sometimes apparently in the same individual, or the modification of one epidemic by the presence of the other, have often been observed in India, and have at times led to an opinion that the two diseases were one and the same. There can be no doubt, however, that both epidemic diseases have been greatly aggravated at times all over India by similar insanitary local conditions.

10. Gurdaspur town, with a population of 4,137, yielded 30 cholera deaths in September. The town appears to be surface drained, "but all outside the wall is for the most part occupied by "stagnant pools, which increase in number in the rains; the dirty water of the town, therefore, is "not carried away, but on the contrary, it stagnates and contaminates the atmosphere here for a "greater portion of the year." Of course the remedy for such a state of things is to fill up all these holes and apply the street sewage for agriculture. A little ground area, and a few shovels ought to remove this source of danger. But, like all surface drained towns, Gurdaspur must supplement the surface drainage by a very efficient conservancy system, otherwise there will be cholera or fever, or both, when their season returns. The Civil Surgeon tells us that "in the smaller lanes and houses "urine and dirty water are, in most places, allowed to sink into the earth, or left to give off effluvia "which contaminate the air the townpeople breathe." Their clothing is described as "dirty, and in "some cases insufficient, dwellings confined, in most cases overcrowded and uncleanly, and in some "with open drains passing through them, one corner of the house being used for kitchen, the other "for a latrine, and perhaps a third for a cowshed. The filth in the latrines is suffered to give off "exhalations from one morning to another," or even to dry on the roofs. The well water is stated to be generally good, but in such a state of conservancy, this opinion would require confirmation by chemical analysis. This town has a municipal committee, and an income which appears to require being laid out to better purpose.

11. The town of Sialkote has a population of 32,989. Between 28th August and 17th October 1881 there were 211 fatal cases of cholera in the town, the maximum mortality coinciding with the maximum death-rate of Sialkote district, which was as follows:—

Months.	Cholera Deaths.	Months.	Cholera Deaths.
January	1	July	1
February	—	August	6
March	—	September	272
April	1	October	32
May	—	November	—
June	—	December	—

Thirty-two villages in the district were attacked. The facts are important, because Sialkote has been somehow or other educated in the belief that quarantine can stay the march of a cholera epidemic.

The first town case took place in an insane beggar who had eaten immoderately, and drank a "quantity of filthy water from a pond of stagnant water. . . . This man had not lately been to "Wazirabad, Lahore, or any other infected locality, nor is there any evidence to show that this man "had any intercourse with any man coming from these above-mentioned places," but otherwise there appears to have been free intercourse between Wazirabad and Sialkote. It is important to remark that the first cholera death in Wazirabad town took place on 18th August, and that all the deaths, 54 in number, took place in August and September. The period of outbreak was the same as in Sialkote town, but if we take the two districts of Sialkote and Gujranwala, within which Wazirabad is situated, together, the history of the epidemic becomes clear enough.

Months.	Cholera Deaths.	
	Wazirabad.	Sialkote.
January	—	1
February	—	—
March	—	—
April	1	1
May	—	—
June	1	—
July	—	1
August	21	6
September	321	272
October	16	32
November	1	—
December	—	—

It is obvious that the epidemic law was the same in both districts, and that no question of importation would throw any light on the attacks. However, the Sanitary Commissioner tells us that every man in Sialkote "believes that the disease was imported here from Wazirabad." But he also tells us that "the circumstances attending the first cases were very carefully investigated, and not only is "there no evidence to show that these cases had any direct communication with Wazirabad people, "but as far as I know none of the latter who came to this city was subsequently affected by the "disease." But suppose a chance case had been traced. Of course all the epidemic history supplied by statistics would have been set aside; or suppose the Sanitary Commissioner had postulated "contagion" as another Government officer in India did on a similar occurrence in 1880, of course the whole case would have been hopeless, and European quarantines against Indian ports would have been the logical result of a fallacy, and the municipal authorities of Sialkote would have felt justified in leaving the poorer districts in the following condition :—"The sanitary conditions of the "house where the first case occurred were very bad indeed . . . . . The natural drainage of "Sialkote town is excellent, and the sanitary condition of the main bazaars and lanes was first-rate, "but the houses as a rule were in a very defective sanitary condition, the cattle and the human "beings being in many cases housed together. This was particularly noticed in Mianspora and "Tibba Kakazayan, and it is to be noticed that the largest number of cases occurred only in these "two mohullas. In the former there were 47 and in the latter 65 cases.

If the townspeople choose to adopt the quarantine theory, it is nevertheless the duty of the municipal authorities to cleanse the houses and to turn out the cattle.

12. These facts about the localizing causes of cholera in the Punjab are important, and they clearly show that although much has been done of late years to improve the Punjab towns, as is evidenced by reduced liability to cholera, there is plenty of work to be done by the new municipalities of a thoroughly practical character. In the Punjab, as in other districts of India, the great predisposing disease causes are to be found, not in public streets and places, but within the houses and compounds, and however clean and well-drained and paved a public street may be, it by no means follows that public health in low filthy damp localities will be improved thereby. This is a cardinal distinction to be observed in improving all towns and villages.

13. *Small-pox.*—Compared with other years the death-rate from small-pox in 1881 was the lowest on record. Calculated on the census of this year the rate was ·36 per 1,000, but small-pox in the Punjab appears to have suites of years of high and low mortality. The highest registered number of deaths was 53,195 in the year 1869, the lowest was 6,749 deaths in 1881, but only two years before, in 1879, 49,489 small-pox deaths were recorded. Generally the months of August, September, and October are months of lowest small-pox mortality, while all the other months show considerable excesses of deaths. The following were the monthly deaths in 1881, and even comparatively few as these deaths were, there was a tendency towards the same distribution of deaths, as will be seen from this abstract :—

Months.	Small-pox Deaths.	Months.	Small-pox Deaths.
January	822	July	521
February	975	August	239
March	974	September	246
April	331	October	285
May	664	November	237
June	600	December	356

Small-pox appears to have been most fatal in the western districts of the Punjab. Two of them, Peshawur and Dhera Ismail Khan, yielded 2,875 deaths; 93 per cent. of all the small-pox mortality was returned in children under 12 years of age. The total vaccinations performed in the Punjab during the official year 1881 were 458,915, of which 432,458 were reported successful.

The following abstract shows the small-pox deaths alongside the successful vaccinations performed during the last four years:—

Years.	Successful Vaccination.	Deaths from Small-pox.
1878	452,655	40,271
1879	450,720	49,489
1880	343,816	9,145
1881	432,458	6,749
Total	1,659,649	105,654

The population yielding these results numbered 18,842,264 in 1881. In these four years 87·5 per 1,000 of the population were vaccinated successfully, and 5·6 per 1,000 died of small-pox. The results not having been considered satisfactory, the Government of the Punjab has re organised the vaccination service under two circles, the eastern and western, in which the following staff has been sanctioned and distributed according to the necessities of each circle :—

Deputy Sanitary Commissioners	2
Native Deputy Superintendent	1
Supervisors of vaccination	20
Civil Surgeon's Clerks	31
1st class vaccinators	39
2nd class vaccinators	67
3rd class vaccinators	149
Total staff	309

We must wait the practical results of this improved service, but in the meantime not a day should be lost in employing this large staff in helping the people to improve their dwellings and surroundings which all past experience shows to be an essential element in diminishing liability to small-pox.

14. *Fevers.*—The conjoined mortality from cholera and small-pox in 1881 amounted to 11,956, equal to a death-rate of 0·68 per 1,000, a small matter when compared with losses from fever, which yielded 355,279 deaths, a death-rate equal to 20·32 per 1,000, or about thirty-fold the mortality of the other two epidemics. The present Report contains a detailed account of a test fever outbreak in Amritsar, which carries with it evidence as to local malaria, producing conditions almost if not altogether of strictly experimental character, but before discussing this case we shall give a general account of the fever and its causes, beginning with the monthly distribution of the mortality, which was as follows:—

Months.	Fever Deaths.	Months.	Fever Deaths.
January	27,990	July	17,423
February	24,952	August	17,249
March	21,801	September	34,396
April	21,383	October	56,868
May	21,843	November	49,203
June	20,801	December	40,325

It will be observed that there was a marked difference in fever mortality in different seasons. The month of maximum mortality in the preceding year, 1880, was October, when 35,762 fever deaths were registered. In November the registered deaths were 32,373, and in December, 31,978. In January 1881, the deaths as already stated were 27,990, from which number they fell in the succeeding months until August, when 17,249 deaths were reported, the lowest monthly mortality which had been registered for several years. But in the next month, September, the registered deaths were doubled, and the maximum mortality, 56,868, was attained in October, and during the last four months of the year, upwards of half the whole fever mortality of 1881 was registered.

Of general and climatic fever causes the most important are rainfall, temperature variations, and food prices. The influence of rainfall can only be considered in its general effects, because as we shall presently see, great aggravation of fever may ensue on purely local rainfalls, and in dealing with the Punjab question as a whole, the Sanitary Commissioner has given the month's aggregate rainfalls of all the observing stations in the Government. In 1881, the months of highest aggregate rainfall were July and August; and in and after September, when there was scarcely any rain, the great rise in fever mortality took place. The cumulative influence of previous rain took effect after the rain had ceased, and when two other elements came into operation, namely, evaporation and lowered and variable temperatures, but there is no information about these last elements in the present Report. The annual influence of cumulative rainfall is, however, well brought out in a diagram giving the relation of fever deaths quarterly; to rainfall every year from 1868 to 1881, with the following results. The total rainfall is not necessarily an index to the fever mortality; sometimes the fever deaths are more numerous with a less than with a greater fall, but in the entire series of years this important fact is brought out, that the maximum rainfall of each year, whatever the amount may be, takes place about the end of the third quarter of the year, while the highest fever mortality shows itself during or towards the end of the fourth quarter. The direct relation between the two classes of facts is further shown by another element, namely, that rapid increase of rain is followed by equally rapid augmentation of fever mortality, until the maximum of both for the year is arrived at. The rain curve quickly descends from its maximum and meets and crosses the ascending fever curve, which, as already stated, attains its maximum height in the quarter following the rain, and this element is connected with drying of ground and lowered and variable temperatures.

Food prices in 1881 were falling, but they were generally higher than in the years preceding the scarcity year 1878.

15. Fever deaths were registered in all the 32 districts of the Punjab, and every registration circle numbering 446, with a solitary exception, returned fever deaths. Of the villages, 34,973 in number, 27,946 suffered from fever mortality.

The lowest fever death-rate of any district was 8·39 per 1,000 at Simla, the highest, 34·78 per 1,000, took place in Amritsar district, and this high rate was connected with the Amritsar epidemic already referred to, which we shall describe because of its great importance to the fever history and fever etiology of India.

16. Amritsar district, excluding the city and suburbs, contains a population of 742,601. In 1881 it registered 17,201 fever deaths, equal to 23 per 1,000. Amritsar city, with a population of 136,166, yielded 11,724 fever deaths, equal to a ratio of 86·1 per 1,000. The suburbs of the city contain 6,449 people, of whom 37 died of fever; a death-rate of 6 per 1,000. As these very varying death-rates took place within the same area, we should naturally look for the influence of locality in the city, while the country death-rates would appear to indicate the operation of more general causes.

In the following abstract are given the actual monthly deaths in each of the three groups:—

Months.	Total Fever Deaths.		
	Amritsar City.	Suburbs.	Amritsar District.
January	209	2	949
February	154	2	677
March	170	0	651
April	189	2	511
May	193	1	843
June	231	2	870
July	171	1	586
August	286	3	703
September	2,352	9	1,666
October	4,279	11	3,715
November	2,540	5	3,883
December	950	0	2,147
Total	11,724	37	17,201

The monthly details of rainfall are not given in the report, but it is stated, on the authority of the Deputy Commissioner, that in June, July, and August 62 inches were measured, of which 38 inches fell in July and August, being 24 inches above the two months' average. The Deputy Commissioner further states, that "the rainfall was not only abnormal in quantity, but singularly limited in area, "extending only a few miles on each side of the city of Amritsar." A fall of five feet two inches of rain in three months, over a limited area including a great city, must necessarily have led to important local consequences. It has been long known in regard to the city itself that the subsoil had become so saturated with filth, that all the well water was more or less polluted. The city lies on a lower level than the surrounding country, the surface drainage of which has been moreover obstructed "by "banks of high level canals and railroads," so that "the rain waters formed large swamps and "became absorbed into the ground, the result being an immense rise in the spring level. . . . "The hollow ground around the city and many gardens became flooded, and turned into lakes, the "water standing in them for months." The drainage outlets were insufficient, and outside the city the surface water mixed with the well water, and in some places subsoil water bubbled up to the surface. The whole subsoil in this way became charged with water, and "the rainfall broke up "and loosened and exposed the stratum of decomposing soil and vegetable matter which "always accumulates some feet below the surface of the ground, in old cities in this country, and "flowing through it polluted the water in the wells." Excavations were made in 15 places inside the jail, and the subsoil water level was reached at distances varying from six inches to two feet nine inches from the surface. In August and September, the fever admissions in the jail, which had been 6·9 per 1,000 of strength in July, rose to 443·7 and 408·1 per 1,000. The Sanitary Commissioner states that, in a well in his own compound to which surface water had no access, the water rose within three feet of the top. The sub-soil was so water-logged that the foundations of buildings were sapped, and damp rose several feet up the walls, and as a general result of sub-soil saturation the city wells showed signs of sewage pollution. "The atmosphere was heavy and moist to an unusual degree, "while from the damp soil drying up under the influence of a hot sun, the ground water at the same "time beginning to subside, organic emanations from the decomposing animal and vegetable matter "contained in it must have been given off in great abundance."

17. Such, then, were the climatic and local conditions accompanying this Amritsar fever epidemic of 1881, but as usually happens the mortality may have been increased by unhealthy dwellings, defective clothing, and want of sufficient food; more than half the deaths took place in children under 12 years of age.

18. Surgeon-Major Bennett, Deputy Sanitary Commissioner of the Eastern District, has supplied an interesting report on the fever itself, in which he states, that "at a comparatively early period of "the outbreak the sickness was so universally prevalent, that not a single individual, native or "European, in the city and civil station appears to have escaped its attacks, nine tenths of the shops "are said to have been closed, and the work of the Government offices was carried on with the "utmost difficulty owing to the general prostration and fever."

The fever showed itself under the two principal forms, intermittent and remittent, to which latter form most of the mortality was due, but there were intermediate forms also. The vast majority of cases were intermittent, of quotidian, tertian, and quartan types. Enlargement of the spleen occurred during attacks, but subsided on intermission taking place. The fever was most fatal during the period of evaporation after rain, and began to decline in severity with diminution of evaporation.

No typhoid appearances were found after death, but rather those which accompany death from slow starvation, which, no doubt, was an important factor in the high fever death-rate. As already stated, choleraic symptoms were present in cases where fever "appeared to mask" cholera.

19. The history of this Amritsar fever is of great importance as showing the relation of local and personal causes to abnormal rainfall in the chain of events, while it yields an epitome of the action of fever causes over most districts in India. But it does more than this, for it shows in another form what relation to public health may at any time exist between canal irrigation without drainage and abnormal rainfall.

The late Civil Surgeon who examined the question addressed a report to the Commissioner in July 1881, before the fever assumed the epidemic form, in which he says that "it certainly appears "evident that the great canals which irrigate this part of the country, as well as that around Meean "Meer, as far as Changa-Manga, have slowly and certainly raised the subsoil water level, and have to "a certain extent altered the conditions of climate. The level of the water is said to have been "raised many feet higher than before the introduction of canals." The zemindars holding lands near the central jail have found that, whereas before the introduction of canals 100 lotas were needed for their water-wheels, they now find in 1882 that 70 lotas suffice. On the authority of the Secretary to the Municipal Committee, it is stated that in Amritsar and its suburbs, the canals have raised the well-water level permanently by six feet, and the available amount of well-water for irrigation has doubled.

As a general concomitant of this great rise in the subsoil water-level, it may be stated that, while in Amritsar district the death-rate from all causes had risen from a five years' average of 32 per 1,000 to 36 per 1,000 in 1881, in Amritsar city the previous five years' average of 61 per 1,000 had risen to the enormous ratio of 125 per 1,000, marking apparently the duplicate death ratio due to rainfall and to local insanitary conditions to which the city population had been exposed before the rainfall took place. Given local conditions under which a 6 per cent. death-rate takes place in Amritsar, and added rainfall to the extent of raising the subsoil water level to the surface, will raise the rate to 12½ per cent. The key to this result is to be sought in local sanitary defects within the walls rather than in abnormal rain distribution, and it is by dealing effectually with these unhealthy conditions that lowered susceptibility to fever in the city must be sought.

The city drainage must be so adjusted that, when the scheme being carried out is complete, it will keep down the water level as far as it may be practicable to do so, because it seems not unlikely that this level within the city depends on the water level of the surrounding country, as well as the rainfall within the city area. But one of the most important works required for protecting the public health is a good water-supply properly distributed, and the filling up of all the wells. At present no dependence can be placed on them for drinking or culinary water.

20. The country problem is one of much greater difficulty. The previous five years' fever death-rate in Amritsar district was 23·45 per 1,000, but in 1881 the rate rose to 34·78 per 1,000, and the added fever death-rate of 11·33 per 1,000 had no other apparent cause except the great rainfall over a district already supersaturated with infiltration from canals and obstructed surface drainage. It is more easy to define the reasons than to suggest practicable remedies for disease causes of this class. But if subsoil water level is raised anywhere by canals, it would appear as if the safest way of obtaining water for irrigation would be to raise it out of the subsoil rather than to float it over the surface from canals, at least in districts where the water level has actually been raised by infiltration. The natural drainages of the district should be restored where defective, and sufficient outlets provided for all added water, in order to secure that amount of movement in the subsoil water which is now known to be necessary for the health of all irrigated districts.

Mr. Bellew has very properly called attention to the fact that the Amritsar epidemic of 1881 is by no means a solitary event, but, on the contrary, he has shown by a table of fever mortality and rainfall for the preceding 14 years that more or less heavy monsoons take place triennially, and are followed by fever outbreaks in the city, and his conclusion is a perfectly sound one, namely, "that "unless steps are taken to provide some such means as may drain away the immense volume of rain "waters which at present stagnate in and about the city, and that not only produce deadly malaria, "but by absorption into the filthy subsoil of the town site poison the already polluted well water, the "recurrence of epidemics perhaps more fatal than the one from which the city suffered last year is "inevitable."

21. It is not often in Indian sanitary history that so careful and minute an account of local fever etiology has been attainable. It has been long known that, other things being the same, excess of rain has been followed by increase of fever, but in the present case the evil has been traced step by step to its culmination in a 12½ per cent. death-rate, of which above 8½ per cent. was due to malarial fevers, and the history shows that, while great local excess of rain caused the fever, it did so on account of water-logging of the whole district leading to stagnant sub-soil water, want of drainage outlets, and in the city itself, foul well water and other sanitary defects. The whole case can be used anywhere in India as affording a clue to local fever outbreaks.

Bowel complaints.—Fatal diseases classed under this head showed a reduction of 3,455 deaths when compared with the mortality of 1880. The deaths presented the usual anomalies in distribution, as evidenced by the fact that, while 423 out of 446 registration circles returned deaths under this head, the mortality was confined to 6,099 population groups out of 34,973 in the province.

The highesst district death-rate of the year was yielded by Simla, namely, 2·83 per 1,000.

The following abstract gives the monthly bowel complaint deaths, and it will be observed that the highest rates from this cause coincided with the highest fever death-rates which took place in the last four months of the year:—

Months.	Bowel Complaint Deaths.	Months.	Bowel Complaint Deaths.
January	1,297	July	1,268
February	1,015	August	1,389
March	1,033	September	2,025
April	1,419	October	2,265
May	1,260	November	1,914
June	1,186	December	1,620

But the highest local fever death-rate did not co-exist with the highest local bowel complaint death-rate. This latter, 7·84 per 1,000, took place in Hoshiapur town, where the fever-rate was 11·26 per 1,000. The next highest bowel complaint death-rate, however, took place in Amritsar town. It was 7·03 per 1,000, with a fever death-rate of 86·10 per 1,000, so that fevers and bowel complaints together nearly decimated the population.

There is nothing further under this head which calls for remark.

23. *Injuries.*—Deaths from injuries were 5,695, including 263 suicides, 4,231 deaths from wounds or accidents, and 1,201 deaths from snake-bite and wild animals, of which last 1,012 were from snake-bite and 139 from hydrophobia.

The recorded deaths from wild beasts were as follows:—Jackals, 6; wolves, 8; tigers, 2; alligators, 2; cat, 1; scorpion stings, 8. The causes of 23 others were not ascertained.

24. Under the head "all other causes," there were registered 129,568 deaths, of which nothing is known except that they included the following monthly deaths from coughs and chest affections, which we here insert as an earnest of further advances in diagnosis.

25. Monthly deaths registered from chest affections, 1881:—

Months.	Deaths.	Months.	Deaths.
January	3,518	July	1,608
February	3,435	August	1,890
March	3,185	September	2,510
April	2,497	October	2,792
May	2,142	November	2,609
June	1,800	December	2,828

It is satisfactory to see that the deaths registered under this designation exceeded those so recorded in 1880 by 2,560.

26. *Sanitary works (Civil).*—Under this section it is stated that the new waterworks, Lahore, had been completed and in satisfactory operation for seven months. The reservoir had given way, but the supply had not been interrupted, and was being pumped directly into the pipes, of which 22 miles had been laid in the principal streets of the city and suburbs. 167 stand-pipes had been put up, and more were in hand. 118 fire hydrants had also been put on the mains. Only 110 connexions had been made with the houses, but this is a beginning, and a progressive increase may be anticipated. An important point is that water is being used without any prejudices. Bistis draw their water at hydrants for distribution. The price exclusive of loan interest is about 2½*d.* (1a. 10p.) per 1,000 gallons.

In the absence of plans and other information in regard to the reservoir which had given way at Lahore, the only remark we desire to make is, that if the work had been properly planned and executed such an event ought not to have taken place.

New waterworks at Delhi and Simla were in progress, also at Ludhiana.

27. There are in the 32 Punjab districts 196 municipalities. The total income of 192 of them, including 103,271*l.* of previous years' balances amounted to 357,083*l.* The years' public health expenditure under the usual classified heads stood as follows:—

	£
Conservancy establishment	38,911
Paving	5,444
Roads and bridges	22,380
Drainage and sewerage	8,886
Water-supply	8,562
Watering of streets	4,361
Constructing latrines	1,416
Repairs of ditto	999
	£90,959

The total amount expended for all purposes was 250,939*l.*, leaving at the end of the year an unappropriated balance of 106,144*l.*, of which a part might have been usefully expended on sanitary work. The proportional expenditure for different purposes stated in the preceding abstract includes that for roads and bridges, much of which would lead to no direct result on public health, and probably not more than 70,000*l.* of the amount could have conduced directly to sanitary improvements. The amount is small, and it is to be hoped that under extended and improved local administration a larger amount of really useful work may be undertaken. It ought to be kept in view as a principle of municipal action that an unhealthy community is always a poor community, and public health expenditure is consequently one of the best and most profitable investments that can be found for municipal funds.

28. It would answer no good purpose to go into local expenditure details, the particulars of which are given in abstracts of local reports, and we shall simply notice a few points of interest in them.

Delhi.—A drainage scheme is before Government for sanction. Conservancy has been improved, and the city is said to be clean and healthy. It is not stated whether the cleansing extends beyond the streets and public places, but it will be evident that very considerable improvements require to be carried out from the fact that in 1881 the death-rate of Delhi was 48 per 1,000, while the previous five years' average was 63 per 1,000. Of the 48 per 1,000 no less than 30·72 per 1,000 was due to fevers. It appears as if a caution were necessary on the manner of disposing of the night-soil of this large city.

It is buried in pits and covered with earth. The ultimate object of this method of dealing with it ought to be to sell it for manure, but great care ought to be taken that no drainage from the heaps can enter any watercourse or pollute the subsoil near dwellings; care should also be exercised in keeping the places of deposit to leeward of houses, for there are no greater risks during cholera times than those which may arise from foul exhalations from these laystalls. In order to use this system with safety the pits should be water-tight.

Simla.—No conservancy scheme for the bazaar and station has yet been undertaken. The Deputy Commissioner states that "the large number of buildings being erected for public offices and "residences for Government establishments make such a scheme every day a more urgent want." Neglect of this kind is quite inexcusable. The "sanitary history of Simla is well known, and unless "the whole place be put in a habitable sanitary condition, Government officers will have to bear "their proportion of loss from cholera as well as the bazaar people the next time this epidemic "disease visits Simla."

Gujranwala district.—"No village committees have been appointed. The lambardars are held "responsible for the cleanliness of their villages. Much attention has been paid to the village con-"servancy during the year under report. In large villages sweepers have been appointed, circular "roads have been marked out, and mud pillars fixed in accordance with the suggestions of the "Sanitary Commissioner and Civil Surgeon."

Mooltan.—The survey of this city has been completed.

Muzzaffargarh.—This division has suffered much from malarial fever, and the executive engineer of the canal division has carried out a drainage scheme affording 16 miles of outlet, so that "all the "canals that used to swamp the tract traversed by the drain now tail into it. . . . . The "people have subscribed the labour from year to year, and the land was given for nothing." It is to be hoped that these swamped districts may now become less liable to fevers.

Peshawur.—The following singular method of conveying water for domestic use requires notice, and may repay careful looking into:—"The new channel, now almost complete, under construction "in the city of Peshawur, has a central channel for drinking water and two lateral ones for sewage, "the latter being on a lower level than the former." The Civil Surgeon has pointed out "the "disadvantage of the water before it reaches the channel in the city being allowed to pass close to "the Sadr Bazaar of the cantonment and other public places in the open streets." It was hoped that in a few days the cantonment would be supplied with filtered water by means of pipes; but what of the civil population?

All that we can do is to suggest that the parties who have carried out the city supply should be called on to justify their proceedings, and to state distinctly how they intend to protect the public supply from accidental pollution. We would at the same time recommend that no similar scheme should be sanctioned for any town in future.

In the smaller municipalities the principal improvements carried out are surface drainage, paving, cleansing, and improvements in wells.

29. Under Section X., "General remarks and personal proceedings," there is some information conveyed of high importance to future sanitary improvements in the Punjab. There are 202 middle schools, in the 3rd class of all of which Dr. Cuninghan's Sanitary Primer is now taught. It has also been distributed among the people and to all the vaccinators, and it is now part of the duty of the Civil Surgeon "to train the vaccinators under his orders in the elementary principles of general sanitation "and domestic hygiene, so as to qualify them for employment as aids in sanitary work."

"The sanitary inspection of towns and villages in all parts of his circle visited during tours or "journeys will form an essential part of the duties of a Deputy Sanitary Commissioner." Similar duties will be undertaken by Civil Surgeons for towns and villages. Both classes of officers have been directed to forward sanitary improvement in places visited by them.

To show that this inspection work is making good progress, the Sanitary Commissioner gives a list of 125 towns and villages inspected by Deputy Sanitary Commissioners and Civil Surgeons, between 1st April and 31st December 1881.

No doubt these outside proceedings are very important. They bring the facts and necessities officially before the people, and they introduce school children to new views in domestic sanitation and economy. But "there is a general concensus of opinion amongst the district authorities as to the "necessity for some organized system of work in the matter of village conservancy, and some officers "advocate the enforcement of the same by law."

This course the Sanitary Commissioner disagrees with, and purposes instead, "that the entire "responsibility for the cleanliness of a village be thrown upon the lambardars, and that they be "empowered to raise by private subscription or in kind, or by other means that may be considered "most advisable by the civil authorities, a sufficient sum to enable them to maintain a fixed or "permanent conservancy establishment of two or three sweepers;" and to give effect otherwise to the advice of the Civil Surgeon, he further suggests that official recognition should be given to zealous officers.

It is clear that whoever is saddled with this responsibility must be provided with funds or be enabled to provide himself with funds. We showed, in our notice of last year's report, that Mr. Bellew had brought village discussions up to the point that the people would do what was needed if they were ordered to do it.

However, it is satisfactory to know that the executive part of the question has been undergoing discussion with a view to its solution.

30. In the course of the year, as already stated, many towns and villages were inspected, and, as illustrations of this procedure and its results, certain details of sanitary defects observed, recommendations made, and works to be carried out, are given for 34 towns and 21 villages visited by the Sanitary and Deputy Sanitary Commissioners and Civil Surgeons. We shall have to wait for the results, but, in the meantime, one lesson taught by this inspection work is that, in the majority of cases, there is no systematic sanitary administration whereby the recommendations made can be carried out. What may be called the sanitary executive can scarcely be said to exist, and it may be suggested that any measures for introducing or extending local self-government among population groups in the Punjab should comprehend within their sphere the improvement of localities and dwellings of the people. This seems to be the practical result of the inspection reports.

31. In concluding our remarks on Mr. Bellew's Report for 1881, the following points appear to require notice.

The most important of them is the now proved relation of stagnant subsoil water, augmented by abnormal rainfall, to malarial fever. Progressive approach of subsoil water to the ground level consequent on canal irrigation, and possibly outlet obstructions due to embankments, without drainage to prevent back watering, may at any time, as has been shown by the Amritsar experience let loose a whole train of consequences ending in great public loss by illness, death, and injury to property. Nobody nowadays would venture to call in question the great public advantage of highways, railways, and canals, whether as means of transit or for increasing agricultural produce of a country. But must it be assumed, as a necessary consequence, that groups of population must undergo a process of decimation from time to time in order that the general public may profit by the works? Where great improvements lie along separate lines, there appears to be danger in overlooking the fact that they may exert injurious influences away from these lines and their objects altogether. What appears to be wanted is simply a grasp over new causes which may be called into existence by new works. No road or railway can run across an imperfectly drained or water-logged country without influencing all the conditions of organic life in its course, and no irrigation work which improves the produce of a region through which it passes but may cause a greater continual loss of life than would be the result of periodical famines. Year by year evidence of this law has been accumulating, and the Amritsar experience has completed the proof of its universal incidence. Does it therefore follow that roads, railways, and canals must be destroyed or left unmade? Certainly not; but what follows, beyond all possibility of denial, is that in hot climates no works of these classes should be undertaken without providing against fatal evils which may accompany their execution and follow it.

There is no mystery in the matter. Every scheme should be considered not only in the view of its professed objects, but in the light thrown by past experience on its possible effects on the public health.

In so far as regards existing works, means should be adopted for restoring all drainages obstructed by railway or canal works. Drainage should be provided for removal of all excess of irrigation water and water raised from wells should be used by preference for irrigation where the water level has been elevated too near the surface by infiltration from canals.

As regards general local sanitary defects, there is nothing new in the year's report. Towns and villages require better drainage, better water, and cleanliness extended from the public streets to the compounds, and houses, and more efficient executive authorities.

This may be done, as already suggested, by extending the principles of local self-government in the Punjab, and the local authorities should have powers granted them to perform the necessary works, and to find the means of execution.

Lastly, we desire to acknowledge the high value of the Sanitary Commissioner's Report of 1881, both in its practical aspect and as throwing additional light on the relation of climatic and local conditions to epidemic prevalence.

19th June 1883.

No. 6.

MEMORANDUM of the ARMY SANITARY COMMISSION on the REPORT of the SANITARY COMMISSIONER for the NORTH-WEST PROVINCES and OUDH for 1881.

1. The following tabular abstract gives the aggregate results of registration in the North-West Provinces and Oudh for the census year 1881 :—

Population, 1881.	Births.		Deaths.	
	Number.	Ratio per 1,000 living.	Number.	Ratio per 1,000 living.
Males - 22,912,556	948,191	21·50	744,435	32·49
Females - 21,195,313	831,282	18·84	658,038	31·04
Total - 44,107,869	1,779,473	40·34	1,402,473	31·79

The birth-rate in this abstract is apparently too high, and the death-rate not high enough, but still there can be no doubt that registration of births and deaths is undergoing considerable improvement in these provinces.

It is perhaps too soon to make use of the element of age in discussing the death-rates, but, as the general registration has improved, we may venture to include these data in the following abstract. It will be seen that ages are only rough estimates.

Ages at Death.	Sexes.	Number of Deaths.	Ratio per 1,000 living.
Infants	Males	243,911	406·74
	Females	213,694	360·04
	Total	457,605	383·50
1 to 15 years	Males	159,621	19·62
	Females	143,514	20·33
	Total	303,135	19·90
14 to 45 years	Males	144,252	18·31
	Females	127,629	12·62
	Total	271,881	12·96
Above 45 years	Males	196,651	58·88
	Females	173,201	50·42
	Total	369,852	54·5

These registered facts must be taken as an instalment of what would be useful information could it be depended upon, but the vague estimates of age prevent their being used for purposes of comparison. As the facts stand they show that deaths under one year of age amount to 32·6 per cent. of the total deaths, and to 25·7 per cent. of the total births. Out of 1,779,473 infants born, the number which would survive the immediate perils of birth and infancy to take their places among the future population of the provinces would be 1,321,868 (that is if the facts were reliable).

2. The next abstract gives the deaths according to class.

Class.	Population.	Deaths Registered.	Deaths per 1,000 living.
Hindus and other classes -	38,137,318	1,220,007	31·98
Muhammadans - -	5,922,886	181,859	30·70
Native Christians -	13,264	607	45·76

When compared with the high death-rate of Native Christians, the rates of the other classes appear to be too low.

3. Mortality varied greatly in different districts. It was highest in the Terai (47·33 per 1,000) and in Cawnpore district (41·45 per 1,000), and lowest in Kumaun (20·88 per 1,000) and in Dhera Dun (20·76 per 1,000). Many of the districts show death-rates apparently below the truth. This result is to some extent confirmed by municipal death-rates, which are probably more correctly registered than those of country districts, although, as the Sanitary Commissioner points out, if

municipal birth and death-rates were alike accurate, many of the municipal populations would be rapidly dying out. The highest recorded municipal death-rate in 1881 was that of Ajudhia, in Fyzabad district. It was no less than 115·26 per 1,000, while its five years' average rate had been 70·42 per 1,000. The lowest rate of the year was 16·31 per 1,000 at Muzaffarnagar, apparently under the truth, as the previous five years' average was 30·10 per 1,000. In a number of Municipal towns the death-rate is below the truth, and the figures vary so greatly, even in towns in the same districts, as to require some explanation of the causes of difference.

This result is no more than might have been expected, but, taken generally, the recent improvements in registration methods have led to more exact record of facts, and we must hope for further advance in the same direction.

4. Similar diversities occur in cantonment returns for 23, of which the average death-rate in 1881 was 25·43 per 1,000. But, taken individually, we find death-rates of 6·40, 7·15, and 7·63 at one end of the scale, and 36 per 1,000 and upwards at the other. There is hence plenty of room for improvement, although a good beginning has been made.

5. *Chief death causes in* 1881.—The following deaths were registered under the usual headings in 1881:—

Diseases.	Deaths.	Ratio per 1,000 of Population.
Cholera - - - -	25,865	0·58
Small-pox - - -	17,153	0·39
Fever - - - -	1,100,599	24·95
Bowel complaints - - -	82,814	1·88
Injuries - - - -	21,060	0·48
All other causes - - -	154,982	3·51
Total - - - -	1,402,473	31·79

The great death cause of the year was as usual "fever," the mortality from which was 25-fold the conjoined mortality from cholera and small-pox, and the deaths of which no account is given were not far short of four-fold the cholera and small-pox deaths. With reference to these deaths from "all other causes," it may be stated that in the Punjab Report for 1881 it is shown that a considerable proportion of them can be separately classed under the head of "respiratory diseases," and this heading affords important information regarding a whole class of causes from which the civil population suffers, and which are veiled under the present nomenclature.

6. *Cholera.*—The death-rates from epidemic cholera, since the North-West Provinces and Oudh were conjoined in the returns, have been as follows:—

	Death-rates per 1,000.
1878 - - - - -	0·52
1879 - - - - -	0·84
1880 - - - - -	1·67
1881 - - - - -	0·58

Last year was a year of low cholera mortality, and its 0·58 per 1,000 death-rate followed a five years' average of 0·95 per 1,000. But even this higher average contrasts favourably with the following yearly rates after registration was established:—

	Cholera Deaths per 1,000.
1865 - - - - -	2·53
1866 - - - - -	0·22
1867 - - - - -	1·95
1868 - - - - -	0·64
1869 - - - - -	3·06

The facts are of the same kind as those observed in the Punjab, namely, that of late years cholera has apparently diminished in intensity and fatality as sanitary work has made progress in the North-West of India.

7. The following was the distribution of cholera in these provinces in 1881. Deaths from it were registered in all the 11 divisions into which the provinces are divided, showing a general diffusion of the disease. But two districts out of 49 in the divisions returned no cholera deaths. There are in the districts 1,107 circles of registration, out of which 431 only furnished deaths, showing that within the registration circles themselves the attacks were strictly local in character, a fact which is also proved by the proportion of villages which furnished the deaths. There are 117,630 of these population groups, and the total cholera mortality of the year was returned by 4,573 of them, or less than 4 per cent. of the number. Cholera in 1881 appears to have conformed to the usual law of diffusion, viz., that a low death-rate indicates a smaller number of attacked population groups and fewer deaths in each, while during severe epidemic outbreaks the proportion of attacked groups and also the number of deaths on an average in each group are raised.

8. The following were the monthly registered deaths in 1881 :—

Months.	Cholera Deaths.	Months.	Cholera Deaths.
January - - -	46	July - - -	2,380
February - - -	96	August - - -	998
March - - -	924	September - - -	485
April - - -	7,935	October - - -	240
May - - -	7,462	November - - -	227
June - - -	4,184	December - - -	228

There are no data in the Report to show the relation between monthly rainfall and monthly cholera mortality. The death-rate itself varied considerably in different districts. In some of them the rates were 01 per 1,000. The highest rate of the year, 2·38 per 1,000, was returned from Basti district. As a general rule cholera was most prevalent and fatal in the south-east regions of these provinces, particularly in the triangular areas between the rivers Tapti and Ghogra, and between the Ghogra and Ganges above their points of junction. "In the eastern districts 7·0 per cent. of the "centres of population provided a record of cholera deaths, against 1·2 per cent. in the centres of "population of the 36 districts west of Allahabad."

9. The most interesting portion of the present report on cholera is that relating to the great twelfth years' fair of 1882 at Allahabad, which is worthy of notice on account of the light it throws on several important points in cholera history.

Allahabad district occupies a triangular area of country between the Ganges and Jumna and the city is situated near the point of junction of the two rivers. The population of Allahabad district in 1881 was 1,386,462, and of the city 87,644. In the same year there were 253 deaths from cholera in the district and 21 in the city, but we have not the returns for 1882.

Allahabad district has rarely suffered much from cholera, as will be seen from the following annual death-rates for a series of years given by the Sanitary Commissioner :—

Ratios per 1,000.

Years.	Ratios.	Years.	Ratios.
1870 - - -	0·1	1876 - - -	1·4
1871 - - -	0·1	1877 - - -	0·1
1872 - - -	2·6	1878 - - -	0·4
1873 - - -	0·6	1879 - - -	0·2
1874 - - -	—	1880 - - -	1·2
1875 - - -	0·2	1881 - - -	0·3

This abstract includes the cholera death-rates in Allahabad district preceding two great twelfth years' fairs, and it will be observed that all the higher rates took place in the years intervening between the great Melas. But it must also be borne in mind that, for reasons which it is not necessary to discuss, this district of the North-West Provinces is much less liable to severe epidemics than many others, so that it would not be safe to assume that what may be done in the way of sanitary care of pilgrims at Allahabad would be sufficient in more severely affected districts. In the same way the experience of Allahabad proves conclusively that something besides the presence of pilgrims is necessary to the outburst of an epidemic.

The next step in the inquiry is to trace the monthly prevalence of cholera in the district during 1881, which will bring the history down to 1882, when the Magh (January) fair was held. This was as follows :—

Months.	Cholera Deaths.	Months.	Cholera Deaths.
January - - -	—	July - - -	8
February - - -	20	August - - -	6
March - - -	53	September	
April - - -	89	October - - -	1
May - - -	71	November - - -	2
June - - -	29	December - - -	—

These facts show a very limited cholera prevalence during the last six months of 1881, and an entire cessation of the disease during the month preceding the fair. The figures include deaths in the city, as well as in the rural parts of the district.

10. The fair was held on a triangular area of sandy ground between the Ganges and the Jumna, at the point where they join at an acute angle, about three miles and a half from the city of Allahabad and about a mile from the fort. The ground occupied by the fair appears to have been about half-a-square mile in area, from which the surface stretches to the point where the rivers unite, and this is the great bathing place; but close adjoining the site is an extensive sandy area, about three miles and a half in length and a mile broad, which appears to have been used as a common latrine, and is marked

on the map as an "area of impurity." The nearest point of this area is distant about a mile and a half from the city. A few common latrines were provided close to the fair site, together with hospital accommodation.

The Sanitary Commissioner states that "the fair site itself was noticed to be well kept as regards "cleanliness. . . . A considerable number of sweepers were employed for its conservancy, and "they worked willingly for the removal and burial of all objectionable sweepings."

But the great area already mentioned could not be dealt with at the time. It must be obvious, however, that in future this evil must be remedied; of course such a state of things could not exist without infecting the air to some distance with noisome odours.

The fair days lasted from the 12th to the 22nd January 1882, but pilgrims began to arrive several days earlier, and the assemblage did not finally disperse until the 26th. This Mela is considered to be of special importance for purification from sin, and the facilities now afforded for travelling brought together no fewer than three millions of people. There was a continual succession of visitors, and it is considered that the average population during the fair period was at least a million. Part of this vast population had shelter under tents, part slept in the open air, but all who could find house accommodation did so. On inspection, it was found that crowds of pilgrims were lodged in every centre of population the site contained, including the city.

"The houses generally overcrowded, many of them quite full of people, lying at night time in "pretty close order, rooms, verandahs, outhouses, temporary shelter of mats, tree-shaded portions of "courtyards, all accommodating to the utmost their quota of people. . . . Surface cleanliness "neglected, the drainage ways choked with sweepings. . . . Attached private retiring places "generally in one corner of the courtyards, overflowing with impurities. . . . The water of the "wells, stirred up by ceaseless drawing, slightly discoloured and of unpleasant odour. This condition "of the water-supply so general that, during all the time of my stay near to the fair site," says the Sanitary Commissioner, "water for camp use had to be brought from the civil lines, a distance of "two miles." The bad water was used by thousands of persons, "not all without complaint, but "apparently in sheer despair of any better supply."

The month of January is usually a time of dormancy of cholera in this portion of the North-West Provinces, and it is not until April that the mortality usually augments in a marked degree, but cholera nevertheless exists, and shows itself more or less during the preceding months of the year. It may be, therefore, taken for granted that this great fair, with its three millions of visitors and its average population of a million, was held in a country and at a time when cholera was more or less present in some part of it to a degree which called for rigid preparation and continuous exercise of precautions necessary for protecting the public health. In the present case, the actual area occupied by pilgrims is considered to have been kept clean, but the same attention does not appear to have been bestowed on the vicinity, and on localities frequented by pilgrims.

The sanitary precautions were, in fact, very defective, and, to all appearance, the only circumstance which prevented a great outbreak of cholera was the absence of what may be called epidemic intensity.

There were, nevertheless, cases and groups of cases of cholera among the pilgrims, which the Sanitary Commissioner became informed of on inquiry immediately on his arrival on the ground. The general belief was that there was no cholera, and the fact was only established by the personal examinations of the Commissioner. The following is a brief digest of the facts discovered:—

For the first four days of the fair, the 12th to 15th January inclusive, a few cases of minor importance were treated at the dispensary. On the 15th diarrhœa was prevalent among the people. On the morning of the 16th five cases of cholera were received into hospital in the city—four in pilgrims resident in the city and one in a girl pilgrim resident near the city. On the 16th and 17th no cholera could be found, but diarrhœa was prevalent. On the night of the 17th a child among pilgrims from Bareilly died of cholera, and three other cases were found on the 18th in the same company. On the same day six or seven cases were found by the Sanitary Commissioner among fakirs lying on the ground. The 19th was the great bathing day; there was great excitement, and "fully a hundred" cholera cases were discovered. By the evening of the 19th cholera appeared on all portions of the fair site, cases were found dead and were buried on the spot. The people became alarmed and began to disperse. On the 20th the most severely affected areas were vacated, but cases of a virulent type were found on other parts of the site, and also on the 21st and 22nd (the latter another bathing day). On the 23rd and 24th the people dispersed and the fair came to an end, but the danger was by no means over. There were great crowds of people at the railway station trying to get away; during the 21st, 22nd, and 23rd, the crowd filled all the space between the station and the city, and every day cholera cases were carried from it to the hospital in the city. A considerable number died and were buried in deep trenches. The trains carried away about 25,000 people daily, "and there can be no manner of doubt that many pilgrims affected with cholera disease were carried "away in the trains, for at almost every station on the line between Allahabad and Cawnpore and "Allahabad and Jabalpur persons affected with cholera in its well-developed stage were taken out "of these pilgrims' trains and cholera disease declared its presence also among groups of pilgrims "travelling by road into Oudh to the east, Bundelkund to the west, and Benares to the south."

It was further reported, but not verified, by the Sanitary Commissioner, that wherever returning pilgrims congregated, cholera appeared among them, and then follows this important statement:—"But although the pilgrims showed this tendency to suffer from the complaint, it seemed unable to "establish itself anywhere among the people who had not been at the fair. Nowhere, so far as I "know, was the return of pilgrims to their homes followed by outbreak of disease amongst the "general population."

The whole history of this fair, and its consequences, could not, of course, be given in the official report for 1881, so that its relation to cholera history in 1882 must be waited for until next year's report is issued. But as the Sanitary Commissioner has given the cholera deaths for January and February 1882 for eight districts, situated in three divisions of the provinces, we may here insert them, together with the corresponding data for 1881:—

District.	Cholera Deaths, 1881.		Cholera Deaths, 1882.		Date of First Death reported, 1882.
	January.	February.	January.	February.	
Allahabad - -	—	20	286	89	15th January.
Futehpur - -	—	—	29	52	22nd "
Banda - - -	—	6	180	164	10th "
Partabgarh - -	3	10	185	132	20th "
Sultanpur - -	10	—	103	388	4th "
Mirzapur - -	—	2	69	30	Unknown.
Benares - - -	13	29	219	54	"
Jaunpur - - -	1	—	101	64	"

In none of the districts in this abstract would the dates of attack in 1882, so far as they are known, correspond with the events of the fair, so as to establish a causative relation between the fair and the earlier cases in the districts; but the Sanitary Commissioner states that a much more minute statistical account was in preparation.

The deaths in all the districts were much greater in 1882 than in the preceding year, and these deaths might have mostly occurred among pilgrims. But, as already stated, we must wait for the whole year's cholera history.

From the facts as they stand it is not improbable that high cholera death-rates among returning pilgrims may have raised the general district death-rates where these deaths were registered; but whatever may have been their influence in this respect, there appears to be little doubt that the sanitary regulation of this great fair was defective in many important points.

Before another fair, the whole vicinity should be kept free of surface pollution, and stringent means adopted to prevent the visitors from fouling the ground. Latrines should be provided in proper places and in adequate numbers. Pure, wholesome water would have to be provided and laid on by pipes, and all overcrowding of Allahabad and the villages prevented. This would involve, as a requirement, that all visitors should provide themselves with suitable covering or shelter, and steps would have to be taken to insure the safety of pilgrims on their departure, and until they arrived at their homes. If pilgrimages on this gigantic scale are to be continued, the duty of protecting the public health should apparently fall on the local municipal authorities, and it would be only just that any expenses required for this object should be levied on the pilgrims.

11. In the month of April 1882, after the Allahabad pilgrims had dispersed, a fair was held at Hurdwar, about 450 miles north-west of Allahabad, which afforded contrasted experience worthy of notice. Hurdwar, as is well known, is a place of pilgrimage resorted to from all quarters. The great fairs are held in March and early in April, the latter month being the time when cholera revives in districts west of 80° east longitude, and the coincidence of revival of cholera, and the dispersion of pilgrims, has often led to the belief that the fair was the cause of an epidemic. In 1882 ample preparations were made for the sanitary protection of pilgrims. The magistrate, assistant magistrate, and police superintendent were encamped at the spot. The site was cleansed and kept clean under English inspectors. Latrines were provided in every place where throngs of people were expected. There was a large horse fair, and grooms and horse dealers were required to keep the surface clean, and to bury the sweepings immediately. A plentiful water-supply was available, and the bathing places were kept clean. General and detached hospitals were established, and means were taken for the immediate report of all diarrhœal cases on the fair site or adjacent towns. The whole arrangements were supervised by the Sanitary Commissioner, who also saw every case of disease admitted to hospital. The sanitary arrangements appear to have been as complete as possible before the pilgrims arrived. There is no information available to show the amount of cholera in this region during 1882. But it was nearly exempt from the disease in November and December 1881. Under these conditions the Hurdwar fair of 1882 was held. The fair lasted ten days, between the 6th and 16th April, and 100,000 pilgrims were present on the chief bathing day. The Sanitary Commissioner estimates a daily average attendance of 60,000. More were expected and provided for, and "from the presence "of only so manageable a number of persons, and the goodness of the arrangements, it resulted that "a most satisfactory cleanliness was maintained everywhere."

The results to health are stated as follows:—"Cases of disease admitted to hospital were never "numerous, generally of little importance, and only one death occurred. This happened in the case "of a Punjabi man, suffering from obstruction of the bowels, said to have resulted from a meal of "new grain." On the 9th April a case of choleraic disease, which recovered, took place in a woman pilgrim from Jummu. This was the only case which occurred at the fair. The Sanitary Commissioner states that he "stayed at the fair until the assemblage had quite dispersed," that he "inquired "carefully concerning the welfare of the retiring pilgrims, and neither saw nor heard any mention of "disease amongst them."

Nevertheless, the newspapers stated that cholera disease "was epidemic at this fair," a circumstance which shows the need of careful observation and record of facts at the time, such as was provided for

by Mr. Planck, both at Allahabad and Hurdwar. The history of this latter fair cannot be completely given until the history of cholera in the North-West Provinces and in the Punjab for 1882 has been reported; but there can be no doubt that sanitary precautions were taken with very different degrees of care, and so far as we can judge from the data available, with very different results in the two cases, as well as of the practical lessons for future management of all fairs which they convey.

12. *Small-pox.*—In 94 towns in the North-West Provinces and Oudh, having an aggregate population of 2,738,788, small-pox deaths, 1,067 in number, were returned from 66.

The country districts have a population of 41,369,081, and returned 16,086 small-pox deaths. The death-rates for both classes of population were precisely the same, namely, 0·39 per 1,000, not much more than a quarter of the preceding five years' average, which was 1·49 per 1,000. The monthly incidence of the disease for the whole population was as follows:—

Months.	Small-pox Deaths.	Months.	Small-pox Deaths.
January	1,386	July	805
February	1,950	August	533
March	2,340	September	137
April	4,636	October	100
May	3,090	November	112
June	1,319	December	260

These figures are in accordance with the monthly law of small-pox prevalence in other districts of India, which cannot be better stated than in the words of the Sanitary Commissioner, who says, "throughout the province a total of 17,153 deaths from this cause were recorded, and of these, "15,401 were registered during the first six months of the year, chiefly in the months of the hot "season, March, April, and May. This proof of unusual prevalence of small-pox in the months of "hot seasons, and its decline as the rains are established has been a marked result of the "registration since its commencement."

The law of annual prevalence of small-pox in the provinces is shown as follows for the last 12 years in death-rates per 10,000 of the population:—

Years.	Ratio per 10,000.	Years.	Ratio per 10,000.
1870	8·	1876	9·
1871	12·*	1877	8·
1872	11·	1878	39·
1873	28·	1879	17·
1874	25·	1880	1·
1875	7·	1881	3·

A knowledge of facts of this class is necessary in estimating the effect of vaccination on small-pox mortality. No doubt the last two years show a great decrease of deaths, but we agree with the Sanitary Commissioner, that the deaths in 1882 and 1883 will have to be still accounted for. If the reduction continues, the table would afford reasonable evidence that small-pox was being influenced by vaccination. The total registered births in 1881 were 1,779,473, but the vaccinations were only 687,916 of all ages:—

13. The following was the topographical distribution of small-pox deaths in 1881:—

(1.) Deaths were registered in all the districts.
(2.) Out of 1,407 circles of registrations, 673 returned small-pox deaths.
(3.) Out of 117,630 population centres (towns and villages), small-pox deaths were registered in 8,198. Many of these must have had single deaths, as the total deaths of the year were 17,153.

The year's epidemic hence covered a very wide area of the provinces, but a small number of population centres, only about 1 in 14, suffered, and among these the epidemic was of very low intensity, and showed little disposition to spread beyond the first cases attacked.

14. Vaccination has been actively carried on; calf lymph has been tried in one of the circles, with the following results, as stated by the Sanitary Commissioner:—"The success (in vaccinating calves) "was complete, and a good supply of lymph was obtained from the resulting vesicles. With lymph "thus obtained, a considerable number of children were vaccinated with most perfect result."

The following was the vaccination staff for the official year 1881–82:—

Superintendents of circles	3
Deputy Superintendents	7
Native "	50
Vaccinators, 1st class	234
" 2nd class	377
Chaprases, and other servants	63
Total staff	734

As already stated, the total vaccinations and revaccinations with successful results were 687,916. The total cost was 11,445*l.*, or 2 annas and 8 pice (4*d.*) per case.

15. *Fevers.*—Under this head were, no doubt, included many cases with febrile conditions due to other diseases, but the Sanitary Commissioner considers that the great majority of deaths are of true malarial fevers.

The following monthly abstract of fever mortality shows anew the influence of climate on the monthly death ratios:—

Months.	Fever Deaths.	Months.	Fever Deaths.
January	75,154	July	58,947
February	72,534	August	60,590
March	76,431	September	83,910
April	90,176	October	158,173
May	84,341	November	154,378
June	62,805	December	130,160

The total fever deaths registered as such were 1,100,599, and of these nearly one half took place in the last four months of the year, showing, as the Sanitary Commissioner points out, that, as in all years, the chief fever mortality is registered in the months immediately succeeding the close of the rains, which are the months of lower and more variable temperatures also.

Fever deaths were returned from all the registration districts, and from all the 1,407 circles with only 16 exceptions, and from almost all villages, which number 117,630, in these provinces.

Ninety-four towns returned 70,418 deaths out of an aggregate population of 2,738,788. The country population, numbering 41,369,081, registered 1,030,181 fever deaths. The town death-rate was 25·71 per 1,000, and the country death-rate 24·90 per 1,000. The fever death-rate for the whole population was 24·95 per 1,000, against a previous five years' average of 21·85 per 1,000. It cannot be said that the comparison is a favourable one for the year 1881.

16. One of the most important predisposing causes of these Indian malarial fevers is a lowered health standard from defective nourishment, and that this factor may have exercised a certain influence on fever mortality may be shown by comparing the prices of the chief articles of food for two years, as follows:—

	Seers sold for a Rupee in December.	
	1876.	1881.
Wheat	23	19
Barley	29	28
Juar	34	29
Gram	31	24

The average prices during the intervening years were for all these grains:—

	Seers per Rupee.	
	June.	December.
1876	29	29
1877	27	14
1878	14	18
1879	16	17
1880	21	23
1881	21	25

The year 1876 was a plentiful year, and the figures show a gradual rise in prices in the scarcity years, which have fallen since then, without having reached the level of 1876. As regards the high price of wheat, the Sanitary Commissioner states that "this is not a matter of very great importance, "so far as the welfare of the people generally is concerned, for wheat never has been a staple of diet "for the multitude in any recent years, but has partaken essentially of the character of a rent-paying "crop." Facilities of transport have also raised the price and tended to equalize it. Still, prices of staple food articles have been raised of late years, and this fact must be taken into account in discussing the fever question.

17. Another cause, affecting the country generally, is rainfall, the amount of which for the year 1881 is given for the 49 districts of these provinces. In 17 districts the rainfall exceeded the average, and in the remainder it was below the average, but in none of the cases of excess does there appear to have been a causative relation between rain and fever mortality. This much it is necessary to state, but the data are too imperfect to enable any reliable comparison between fever deaths and

meteorological elements to be drawn. There are, however, data of a certain kind yielded by the irrigated districts, which may be given as follows:—

Irrigated Districts.	Fever Mortality per 1,000.		Rainfall above or below Average.
	Five Years' Average.	1881.	
			Inches.
Meerut - - -	34·28	38·51	− 2·
Muzaffarnagar - -	29·98	29·26	− 6·4
Bulandshahr - -	40·19	29·19	− 0·3
Furrukabad - -	27·38	27·24	+ 5·2
Saharanpur - -	22·20	27·13	− 6·4
Etawah - - -	25·31	26·68	+ 7·4
Mainpuri - - -	29·72	26·41	+18·1
Cawnpore - - -	28·03	26·29	+ 9·9
Aligarh - - -	39·17	23·42	− 2·9
Etah - - -	29·95	25·46	+11·
Muttra - - -	38·60	22·41	+ 3·2
Agra - - -	34·83	23·24	+11·5

The last four irrigated districts in this abstract show a decided falling-off in fever mortality in 1881, although in only one of them, Aligarh, was the rainfall below the average. In the other three the rainfall was considerably above the average, and in these three, at least, we should have expected a larger percentage of fever deaths. In all four there was a large reduction of fever deaths, a fact which is accounted for by the Sanitary Commissioner as follows. He says, "This is satisfactory, "and may result from the action of drainage works, and a more careful distribution of water." If this view be accepted, it would follow that these drainage works had not only greatly reduced the liability to fever in the districts, but had removed the excess of rain, and consequently the additional mortality which otherwise might have been due to it.

The other irrigated districts, with the exception of Meerut, show a considerable similarity in fever death-rates for 1881, and these have not, apparently, been influenced either by excess or reduction of rainfall. It would be interesting to know whether drainage works have been executed in Bulandshahr district, for the reduction of mortality has been more remarkable there than in any other district.

These facts, as they stand, show that drainage of irrigated districts reduces fever mortality. On the general question of the relation of fever mortality to irrigation works, there is nothing in the present year's report to modify the opinions we expressed in our memorandum on the report for 1880, which have, moreover, been strikingly confirmed by experience since obtained in the Punjab.

It may be now considered as proved that, if water for irrigation be introduced into a district, and supplied in excess of requirements of agriculture to such an extent as to waterlog the subsoil and raise the subsoil water level, there will be an increase of mortality from malarial fever; and further that, under certain atmospheric conditions, including large rainfall, fever deaths may attain the dimensions of a great pestilence.

18. Taken by "districts," the fever death rates lay between 8·23 per 1,000 in Lalitpur in Jhansi division, the lowest rate, and 41·41 per 1,000, the highest, which was registered in the Terai, a rate which was 10 per 1,000 above the preceding five years' average, although the rainfall was 44·5 inches, against the average of 48·1 inches.

In this case the actual rainfall of the year, together with other undescribed meteorological elements and the usual subsoil conditions, appear to have co-operated in raising the fever-rate. But if the fever mortality be taken by circles, as shown in the fever map, it will be seen that the highest death-rates were purely local. As already stated, fever deaths were returned from 1,091 circles of registration out of 1,107, but to only 26 of these circles are excessive death-rates assigned on the map, and they are scattered all over the provinces close to the great rivers, or to the irrigation works, except the Terai circles. The highest circle death-rate is that of Ballia, 69·5 per 1,000, which is one of the four circles occupying the triangle at the junction of the Ganges and Ghogra.

The other three circles have rates as follows—41·7, 40·7, and 30·9. It may be remarked that the circle Bairia, where the lowest rate took place, has the Ganges on one side and the Ghogra on the other. In the canal irrigated districts the highest rates may be taken generally at between 4 and 5½ per cent., very high rates no doubt, but occurring among small populations and in only a few groups.

19. Of towns, the highest local fever-rate of the year was returned from Ajudhia, in Fyzabad district. This town, with a population of 11,643, had a death-rate from all causes of 115·26 per 1,000, of which no less than 81·68 per 1,000 was due to fevers. There must be something radically defective in this place, for its death-rate, on a five years' average, has exceeded 7 per cent. from all causes. Little is said in the present report on merely local conditions which have been often discussed by the Sanitary Commissioner in previous years. It may, however, be taken for granted that these operated as usual in the year 1881, and the fever history of the year appears to show that, while there was an average series of death-rates over the provinces, the rates were augmented considerably above this average in certain defined areas, where besides purely local causes, the influence of subsoil damp from rivers and canals came into operation. The practical conclusion from the year's experience is the same as that of former years, namely, that local disease causes in villages and towns should be

actively removed, that local drainage should be rendered more efficient, especially in canal irrigated districts, and that irrigation water should cease to be applied in excess of the requirements of vegetation.

20. *Bowel Complaints.*—Under this head the following monthly deaths were registered in 1881:—

Months.	Deaths.	Months.	Deaths.
January	6,319	July	6,261
February	5,383	August	7,227
March	5,658	September	7,682
April	7,581	October	8,212
May	7,556	November	8,000
June	6,192	December	6,243

The death-rate for the year from these diseases was 1·88 per 1,000, while the previous five years' average was 2·26 per 1,000. Deaths from them were returned from all the 49 registration districts, and from 1,029 registration circles out of 1,107, but no return was made of the villages registering deaths.

A list of eight districts is given in which bowel complaint deaths were unusually numerous. These are considered by the Sanitary Commissioner to be chiefly dysentery, "probably due to malarial "prevalence as much as fever itself." In one district, Cawnpore, the deaths for the last five years have given the following rates per 1,000 from bowel complaints and fever:—

Years.	Bowel Complaints.	Fever.
1877	1·0	19·6
1878	1·2	20·5
1879	1·1	46·3
1880	6·2	29·0
1881	6·3	26·2

These increased rates have, it appears, accompanied extension of irrigation works.

If this connection were established, the fact would show that there is a relation of dysenteries to subsoil water level.

21. *Injuries.*—Under this head were registered deaths from the following causes:—

Suicides	2,233
Wounds or accidents	13,017
Snake-bites and wild beasts	5,810
Total	21,060

Deaths from these causes, though below the five years' average, are still high. Destruction of wild animals might be more efficiently followed up with advantage.

22. *Sanitary Works (Civil).*—Sanitary work has made progress during the year, chiefly in municipalities, 65 of which are named as having executed improvements of some kind. None of these are on any great scale, and have been mainly confined to surface drainage, roads paving, better conservancy, cleansing wells, and other works of the same class. A few cases of these may be introduced by way of illustration.

Almora has had its whole site drained, and the town has a plentiful supply of good water. The public latrine arrangements were extended. The death-rate of this municipality was 17·45 per 1,000 in 1881.

Terai.—Drainage lines have been extended and improved.

Bulandshahr.—"A work of considerable sanitary importance" for preventing flooding has been carried out, and town improvements have been in progress. "Mean looking houses are being "replaced by new and handsome buildings, to the quite altered aspect of the town generally. And "it is only just to say that Bulandshahr, in its renewed appearance, may rightly claim the first place "in the race of town improvement which has characterised the municipal government of recent "years." It is right to add that these results are ascribed to "the wisdom and conciliatory character "of Mr. Growse's management."

Bulandshahr town has a population of 17,863: its death-rate in 1881 was 24·24 per 1,000, and its previous five years' average death-rate was 43·27 per 1,000.

At *Cawnpore* city "a total length of 13,509 running feet of the new drainage system was con-"structed." Two unwholesome excavations in the middle of the city were filled up and levelled. It is evident, however, that the real disease causes in this city of 120,161 inhabitants have not yet been reached, as is shown by the fact that its very high average death-rate for five years past, namely, 42·35 per 1,000, was raised in 1881 to 50·93 per 1,000, of which no less than 38·96 per 1,000 was due to fevers.

Benares has forbidden keeping of pigs within the city limits, and tanneries have been removed, but as regards permanent works the Sanitary Commissioner tells us that "the long proposed water-"supply and drainage scheme has made no progress, it still remains under the earnest consideration

" of the municipality " but disease and death levy their municipal tax notwithstanding. Benares contains 193,035 people and its five year's average death-rate of 26·67 per 1,000 was raised in 1881 to 45·39 per 1,000. In the course of the year, no fewer than 5,270 of its people died of fever.

At *Lucknow*, 30,838 feet of stone and masonry built drains were constructed, some new wells were sunk, 17 ditches had been filled up and 36 others were in progress of filling, 5 latrines were built, and an artesian well sanctioned. The death-rate of this large city of 239,773 inhabitants had fallen from a five years' average of 46·01 per 1,000 to 40·63 per 1,000 in 1881. Its fever death-rate was 25·91 per 1,000. High as the rate is, we should consider it a good sign if the rate of 1881 were the result of good work done.

In the other smaller municipal towns, the works have been of the nature already described, simple, inexpensive, and no doubt advantageous to the public health.

Works of a more important class still under consideration are the water-supply and drainage scheme for Benares, already mentioned, plans and estimates for which had been in existence for the preceding two years; the drainage scheme at Azamgarh; water-supply for Agra and Lucknow, and drainage schemes for Bareilly and Gorakhpur.

23. *Villages.*—We are glad to learn from the present Report that, " during the year 1881, a very " considerable progress has been made towards the realization of a better sanitary state of the larger " villages in the province," namely, places with from 1,000 to 4,000 inhabitants, in which gradual " increase of population had not been met by corresponding improvements in village sites, conservancy, water-supply, &c.

A year or two ago step were taken by certain local officers to remedy the observed defects with considerable success, and the Government issued a Circular, No. 158 of 1880, in which the action that had been taken in Banda district was set forth for imitation. It was found that in Baraich district there were 30 of these large villages, and the following rules were issued, viz., that all refuse must be removed to a distance at least 200 yards from the villages, and no nuisance to be permitted nearer; all wells to have their mouths raised and the surrounding ground to be kept clean; and the floors of cattle sheds to be raised above ground level. " Tahsildars and thanadars were required to " submit weekly statements to the Deputy Commissioner showing the degree of obedience locally " accorded to the rules proclaimed."

These rules were followed by village officers, " and in no instance was any spirit of opposition to " the rules evinced. There were cases of neglect which were met by special letter or by a small " fine." The following was the result of these measures :—

" After 12 months' experience of the working of the rules Mr. Ferrar, the Deputy Commissioner, " records the belief that the general public opinion favours the action of the rules, from which an " improved sanitary condition has undoubtedly resulted in the villages concerned." These larger improved villages escaped cholera during the year at a time when it " was claiming victims in the " neighbouring smaller villages." In consequence of this, the rules were to be extended to 80 more important villages. Similar rules were proclaimed in 14 of the largest villages in Julaun in May 1881, and by the end of the year 65 villages were brought under their operation. The pargana officers were directed to inspect these villages, which they did carefully and completely, and not the slightest opposition was made to the rules. Boundary pillars were set up at 200 yards from the villages to mark the area within which no impurities were to be deposited. These are considered by the Deputy Commissioner of importance as giving the people a visible proof that obedience to the rules is expected. Already seven villages had been so far improved that letters of approval had been sent to the lambardars.

24. Connected with this same subject is a summary of reports of Deputy Sanitary Commissioners, most of which is devoted to vaccination work, but there are nevertheless matters contained in the summary to which pointed attention should be called. Some years ago the hill station of Chakrata in the Himalayas was selected for troops after careful examination and comparison with other sites, and when the water-supply came to be provided, Dr. Pringle states in his report that the method adopted was only suited to hill village irrigation purposes. He " condemns the water-supply now in " use there by the troops as liable to contain surface impurities, which will eventually produce " general sickness," and advises conducting a supply from a source in the Deoland mountain by iron pipes at a cost of Rs. 20,000. He advises a similar plan for improving the water-supply of Mussoorie. We have several times had occasion to notice the quite original methods of providing bad water for domestic use in India, and here is another example. At Agra the wells are brackish, and what the city requires is simply a proper water-supply. But lately the notable expedient has been adopted " of " allowing the rainfall to drain into them," the assumptions of course being that the rain will leave all impurities it may have carried with it before it falls into the wells. Dr. Taylor considers that the foul and putrid state of the water provided for cattle is the chief cause of cattle diseases, as no doubt it is in India as everywhere else.

The Deputy Sanitary Commissioner has made recommendations as to the cleanliness of villages and protection of wells, which we hope will receive attention on the part of the authorities. Another Deputy Sanitary Commissioner, Dr. Richardson, visited and reported on the sanitary state of 222 towns and villages during the year. He gives some interesting information about the hill cholera which is worthy of notice. He says, the filthy state of many of the hill villages is " brutal." Pilgrims come and go through them, and every spot of ground is fouled by them, so as to taint the air to a distance.

In May 1881 an outbreak of cholera took place in Gharwal; the disease appeared chiefly on the pilgrim routes to Kedarnath and Badrinath temples. The former is an old epidemic centre. In the present case " very few of the wayworn ill-fed pilgrims suffered from the disease." The chief victims

were the foul living villagers. Cholera this year attacked villages formerly the seat of the hill plague, and people and cattle still inhabit the same houses. In one village the first attack was stated to have taken place in a pilgrim.

The only wonder is, that plague and cholera are not always present. Rules against these foul habits have been issued, but "it is one thing to issue orders in the hills, and another to see that they "are attended to."

25. Under the head of *General Remarks*, Mr. Planck resumes the year's work briefly. The general tone is hopeful. Much good work is being done, but there is a tendency to relaxation of effort, showing the extreme importance of constant supervision. To this end the Deputy Sanitary Commissioners have been placed in communication with local authorities, and provided with heads of a report to be filled up after each inspection, and handed to the local executive. We must hope that the improvements in local self-government which are to be introduced may lead to enlisting the services of gentlemen who take an interest in public improvements, and in forwarding improvements in public health.

26. In conclusion, it can scarcely be said that there is much new in the present year's report. This, indeed, could not be looked for. The sanitary state of the provinces is now well known. Everywhere there exist the usual local disease causes incident to past town and village life, the tendency of which has been to increase, from want of local knowledge and effort to remove them: and besides these, in certain areas, there have been great and useful irrigation works carried out, but in the absence of drainage, and regulation of irrigation water-supply. This important matter will be dealt with by the Government; but all other measures such as local cleansing, draining, improvement of water-supply, house and compound improvements, paving, levelling of surfaces and filling up or draining useless water holes, tree planting, and the like, will fall on the local authorities.

We are glad to learn from the Government orders that approval has been given to the proposed reporting by Deputy Sanitary Commissioners of all local defects; but they should also report to their chief how their recommendations have been carried out, and we join heartily in the hope expressed by the Government that "the municipal and district boards, as they are hereafter to be constituted, may "be expected to take an active and intelligent interest in sanitary reforms, and any suggestions made "will doubtless be readily accepted, and acted upon, so far as may be consistent with local conditions "and financial considerations."

Mr. Planck, by many years of labour, has brought the sanitary knowledge of these provinces into such a condition, that what is most wanted now is action in dealing with local disease causes, and we must look to the new municipal institutions for this. In the meantime we cordially join with the Government in their acknowledgment of Mr. Planck's work, and its value to the public service.

11th June 1883.

No. 7.

MEMORANDUM of the ARMY SANITARY COMMISSION on the REPORT of the SANITARY COMMISSIONER for the CENTRAL PROVINCES for 1881.

1. Since the Report on the sanitary condition of these provinces for 1880 was sent in, Deputy Surgeon-General Hutchinson, who was in the first year of his service as Sanitary Commissioner, and who drew up that Report, has been replaced under the new arrangements by Deputy Surgeon-General Dr. Simpson, who states that he was "wholly unacquainted with these provinces" when he entered on duty on the 3rd April 1881, and that his predecessor had left only one section of the present Report, on "the chief diseases," completed. It is necessary in alluding to changes of this kind to state that they cannot add to the efficiency of the sanitary service anywhere, and that it would obviously be advisable, in appointments combining the headship of the sanitary and medical services in the same officer, to do the best possible, with a due regard to the interests of both services, to enable the Sanitary Commissioner not only to acquire knowledge of the multitude of public health details in his districts, but to turn his experience, when once obtained, to the advantage of the public service generally.

2. The present Report begins with Section V. of the arrangement, that, namely, on the vital statistics of the general population; but in discussing the data certain reservations have to be made, because the population element used in the Report is not that of the census of 1881, which was 11,504,149, neither is it the population of the previous census of 1872, which was 9,251,229, because under both enumerations the census included areas not under registration.

The numbers in the present Report are those only which were within the registration areas of 1872, namely, 7,409,865, but, as the total population of the provinces had increased by 25 per cent. in the decade, there must have been a corresponding increase within the areas of registration, and a corresponding decrease in the ratios of births and deaths. We shall, however, adopt the numbers in the Report, in the hope that the necessary corrections may be introduced at an early period. The ratios obtained from them can in the meantime, be used, not as absolute facts, but for purposes of comparison.

3. The population of these registration areas was, then, 7,409,865 in 1872. In the same areas there were registered 362,744 births in 1881, giving a ratio of 48·94 per 1,000, probably 25 per cent. too high; were it otherwise, certain of the districts would have birth-rates of between five and six per cent.

The deaths registered in 1881 were 241,647 in number, equal to a death-rate of 32·59 per 1,000 on the assumed population. It seems scarcely necessary to discuss the question further, but the actual numbers of births and deaths registered would appear to point to improving registration, and what is now wanted is to work out the true population of these registration areas and towns on the census of 1881, and to use this in calculating the ratios. The Sanitary Commissioner himself gives an excellent example of the need of these corrections by citing the case of Murwara town, which, in 1872, had a population of 2,885, on which the death-rate in 1881 amounted to the enormous figure of 112·30 per 1,000. This result led to special inquiry, and it was found that in the decade the population had increased to 8,612, making the true death-rate 37·62 per 1,000.

4. *Chief death-causes in* 1881.—The following deaths were entered under the customary headings in 1881:—

Diseases.	Deaths.
Cholera	9,140
Small-pox	1,816
Fevers	148,933
Bowel complaints	22,133
Injuries	3,957
All other causes	60,488
Total	241,467

We shall discuss each of these death causes, briefly beginning with cholera.

5. This disease was prevalent in an epidemic form along the sea coast and river deltas skirting the eastern boundary of the Central Provinces in January 1881, and in the same month it appeared in Burgarh registration circle, in Sambalpur district, about 150 miles from Cuttack, and the Mahanadi delta. Before the disease broke out at Burgarh it attacked one or two boatmen at Binka on the Mahanadi river, but Burgarh is the first circle which returned cholera deaths.

Between February and April there were 126 deaths in Sambalpur district, when the epidemic disappeared, but in August following there was a solitary death in the district. All the deaths took place in 20 villages out of 886 in the district, showing a low intensity of the epidemic, and no great diffusion of it in this eastern boundary district. In the region coterminous with the endemic cholera area of Bengal there was comparatively little cholera, and the epidemic covered the whole eastern regions of the provinces lightly, but it assumed the dimensions of a true epidemic in the western and north-western districts. There were, however, fatal cases in every district of the provinces, 20 in number. Out of 168 registration circles 106 recorded cholera deaths, both facts showing a very general diffusion of the epidemic, but, as usually happens, the losses of life were strictly local, for out of 27,247 population groups, including 72 towns, all the deaths were registered in 1,132 groups, of which 36 were towns. It follows that 50 per cent. of the towns yielded cholera deaths, 938 in number out of an assumed population of 483,582, while only 4 per cent. of the villages were attacked out of an assumed population of 6,926,283. On the registration district census of 1872 the cholera death-rates of these provinces in 1881 would have been as follows:—

	Ratios per 1,000.
Towns	1·94
Villages	1·15

No doubt in both cases considerably above the true ratios.

6. The following was the monthly distribution of cholera mortality in 1881:—

Months.	Cholera Deaths.	Months.	Cholera Deaths.
January	12	July	958
February	83	August	1,961
March	152	September	1,963
April	494	October	813
May	1,086	November	90
June	1,519	December	3

In January and February there were 95 deaths registered in six registration circles in Sambalpur, Raipur, and Bilaspur districts, nearly all in villages. The only town deaths registered were five in Dhametri and one in Bilaspur; the other eight towns escaped the disease. As shown on the map, cholera over all the extensive eastern portions of the Central Provinces was more sporadic than epidemic in its distribution, but it assumed a distinctly epidemic character in the north-western districts, again fading away in the west as an endemic. Similar distributions of cholera have appeared in former years.

A number of reports of Civil Surgeons as to the mode of origin and extension of cholera are given by the Sanitary Commissioner. Some attribute the disease to pilgrims, others to the usual law of epidemic progress. The pilgrim data are not given with sufficient minuteness to enable us to judge whether the opinions founded on them can be accepted. Many years ago we called attention to similar defects in these inquiries, and nevertheless the Government state, in their letter prefixed to the present Report, that "the opinions of medical officers as to the mode of propagation of the disease "cannot be said to be generally of much value. They seldom seem to be founded on any careful "examination of facts."

A few "really tried to weigh the evidence supplied by the facts of the history of the disease in their "districts, but the majority seem to have been content with vague and uncertain generalization." It seems to be unnecessary to pursue this subject further. As the evidence stands, cholera appears to have invaded the provinces from the east, but the true epidemic covered not the eastern, but the western regions of these provinces, and there it evidenced its usual erratic character, coming and going, active at one time, quiescent at another, following no special line or order of march, and disappearing without evident cause. Its severity displayed the same erratic character; in one group of villages there might be few deaths, while in others close at hand there was great loss of life. It would leave a village or group in its course and attack others out of it, returning again to take its victims from localities it had previously passed over.

These characteristics of cholera in these provinces are well brought out by the reports of Civil Surgeons. They cannot as yet be made amenable to any law of causation or movement, and must at present be accepted simply as facts.

A similar time irregularity is shown in the following abstract of death ratios from cholera for the last 13 years. The ratios are given as deaths per 100,000 to avoid fractions:—

Years.	Deaths.	Years.	Deaths.
1869	1,050	1876	271
1870	—	1877	46
1871	—	1878	553
1872	21	1879	377
1873	4	1880	4
1874	—	1881	128
1875	198		

We have no means of accounting for these anomalies. The endemic sea-coast and river delta areas adjoining the eastern boundaries of the provinces have been the same year after year. Juggernath pilgrimages have been carried out as usual, from which pilgrims have gone and returned across the provinces, and yet for entire years there has been no cholera, while in cholera years the death-rates have varied between 4 and 1,050 per 100,000 of the population. We are thus brought back to the influence of local conditions and personal habits among the people *when cholera was present in the country*, on the amount of loss of life.

7. We referred to this important point in sanitary inquiries in our memorandum on the Sanitary Commissioner's Report for 1879, and suggested that, while making sanitary inspections of localities, an endeavour should be made to connect the disease history with sanitary conditions. This to a certain extent has been done in the report under review, but it may be well to introduce a caution in the manner of using the observed facts, because there appears to have been an impression that insanitary conditions were considered to be directly causative of cholera. This is not so; the facts of every epidemic tend to show the contrary. In the present Report the Sanitary Commissioner states the case as follows: "Enough has been said to prove that cholera does not confine its ravages to the dwellers in filthy "villages, it would be scarcely possible when this disease is prevailing in an epidemic form that this "should be so, for this active poison must declare its potency upon whatever locality it falls. But there "seems to be sufficient evidence to prove that were the sanitary condition in the Central Provinces "universally good the barrier placed to the progress of cholera would be so great as to check it, if not "entirely, in great measure." The only difficulty in accepting this view in its totality is the absence of definition as to what are meant by "clean villages," because no village, whatever its outward aspect may be, can be considered clean from the side of public health, in which the compounds or houses are foul and the water-supply derived from foul ground near cattle sheds, dung-heaps, or cesspits. But, on the other hand, it has long been admitted that an epidemic may be so intense in its action as to destroy all people on whom it falls. This occurrence, however, is out of the range of experience, but all are agreed as to the predisposing influence of certain local and personal conditions when cholera is present, and it is with these, which are matters of experience, that we have to deal. Our suggestion already referred to was intended to bring out any facts showing the results of local sanitary work on the death-rates, bearing in mind that such apparent results should not be confounded with low mortality due to local mildness of the epidemic.

8. As a contribution to this inquiry, the Sanitary Commissioner has given the names of a number of cities and Sadhr towns where sanitary improvements have been carried out. In several of these there were no cholera deaths, and the others suffered comparatively little loss. We have placed these towns in the following table, and, in order to eliminate the effect of low cholera intensity in their vicinity, we have introduced the cholera mortality in the districts within which the towns are situated. The ratios are in deaths per 100,000, to save fractions.

Towns.	District.	Town.	Towns.	District.	Town.
Sambalpur	41	None	Wardah	249	93
Bilaspur	41	"	Damoh	110	159
Mandla	30	"	Jubbulpore	231	109
Saugor	33	"	Nagpur	254	71
Hoshangabad	12	"	Narsinghpur	233	161
Khandwa	12	7	Chindwara	86	33
Betul	1	None	Chanda	57	12
Seonie	163	"	Bhandara	133	35

Taken generally, the facts show losses from cholera in towns far below the intensity due to the districts, and as all of them have been undergoing improvements more or less, the results augur favourably for the future, that is, provided the work is not only maintained but extended, because it is easy to see that, with a more intense epidemic, there might have been much more loss of life in these towns than actually occurred. It is a remarkable fact that, although 36 towns out of 72 in the provinces escaped cholera altogether, every district in which the exempted towns are situated suffered from cholera. Moreover, with the single exception of Kamptee, a town of 48,831 people, which yielded 116 cholera deaths, all the towns of largest population comparatively escaped. The most populous town in the provinces, Nagpur, contains 84,441 inhabitants, and yielded only 66 cholera deaths. Jubbulpore, with a population of 43,223, connected by roads and railroads with cholera infected regions, had only 47 deaths. Saugor district, with a population of 455,845, yielded 150 cholera deaths, while Saugor town, with 31,119 inhabitants, and Saugor cantonment, with 14,536, escaped the disease. These statistical facts appear to justify an opinion that sanitary work, such as it was, in the towns and under the prevailing epidemic conditions, had been effective in saving life, and the evidence of this, which they afford is more satisfactory than the opinion of such of the Civil Surgeons as have reported on the subject. It appears that there was some want of distinctness in the instructions under which they acted, and hence their reports are not detailed enough, but this will, no doubt, be rectified in future.

We may repeat here what has been often urged in different memoranda, that no adequate idea can be formed of sanitary condition, in reference to epidemic susceptibility, from a mere surface inspection of towns and villages, for it is already known that the most potent disease causes are those inside house compounds, where keeping of cattle, filth cesspits, and wells dug in foul subsoils are far more active predisposing causes of disease than filth in public streets or undrained surfaces. The new local authorities to be entrusted with care of public health in these provinces will have to deal with disease causes of this class as well as with the usual outside work.

9. *Small-pox.*—There is little information in Civil Surgeons' reports on this epidemic disease, but there are some facts revealed by statistics which are of importance.

The Sanitary Commissioner has given a table showing the annual death-rates from small-pox in each of the districts for 13 years, and the following annual death ratios for the province will show the law of prevalence.

Years.	Small-pox Deaths per 1,000.	Years.	Small-pox Deaths per 1,000.
1869	3·40	1876	0·51
1870	0·30	1877	0·37
1871	0·20	1878	2·18
1872	0·57	1879	3·44
1873	1·37	1880	0·69
1874	2·38	1881	0·24
1875	2·37		

These ratios show distinctly the epidemic nature of small-pox, while they show that this disease is always prevalent in the provinces, which, as we have already seen, is not the case with cholera; it is usually more generally diffused than cholera. In 1881 small-pox deaths were returned from all the 20 districts and from 112 registration circles out of 168, but the outbreaks appear to have nevertheless been strictly local, as all the year's small-pox deaths, 1,816 in number, were returned from 879 villages out of 27,247 in the provinces, showing that by far the greater proportion must have had no more than a single death.

The following abstract shows the monthly mortality in 1881:—

Months.	Small-pox Deaths.	Months.	Small-pox Deaths.
January	65	July	218
February	71	August	227
March	153	September	84
April	252	October	51
May	275	November	99
June	210	December	120

As usual, the dry hot months have afforded the highest death-rates. Deaths arranged according to age gave the following proportions in 1881:—

——	Deaths.	Ratio per cent.
Under 1 year	643	35·4
1 to 12	809	44·5
Above 12	364	20·0

During the past five years, there have been 51,411 small-pox deaths and 1,507,238 vaccinations, or in round numbers, one death for every 30 vaccinations. The births registered in 1881 were 362,744,

while the average number vaccinated would be about 301,448. There appears to have been a noticeable relation in some of the districts between a high vaccination-rate and a low death-rate from small-pox.

10. *Fevers.*—The conjoined death-rate from cholera and small-pox, 10,956 deaths is a small matter when contrasted with fever deaths, 143,933 in number. The approximate fever death-rate was 19·57 per 1,000 for the districts, and 17·30 for the towns—a difference in favour of the latter of 2·27 per 1,000, which, we must hope, marks the influence of sanitary work in the towns. The death-rate for the whole population, town and country, was 19·42 per 1,000 in 1881, against a previous five years' average rate of 20·84 per 1,000.

11. The following abstract gives the monthly fever deaths in 1881 :—

Months.	Fever Deaths.	Month.	Fever Deaths.
January	9,959	July	9,557
February	9,206	August	12,996
March	10,446	September	15,238
April	10,966	October	17,555
May	12,013	November	14,970
June	8,791	December	12,905

The months of June and July are usually the months of lowest fever mortality of the year, although the actual number of deaths in these months appears to bear a certain relation to the year's fever deaths. We have no means of collating the monthly mortality with rainfall, but the year's rain, which amounted to 54·32 inches, was above the average of the preceding five years. A greater influence, however, is exerted on the public health by rain distribution than by the actual amount which falls in the year, and probably the explanation given by the Sanitary Commissioner is the correct one. It is as follows :—"July is a month when the monsoon has commenced, and there is an "equable temperature and freedom from those baneful influences which are developed later on in "the year, after a long continuance of rain and an advance in the season have generated the "conditions favourable for the development and action of malaria."

Although this view may be accepted, still, as we have often pointed out, the reporter should have the means placed at his disposal of comparing monthly meteorological elements with fever prevalence. It would be a step in arriving towards scientific accuracy in these important discussions.

12. The distribution of fever mortality in 1881 presented some points of interest, which may be noticed. Fever deaths were returned from all the registration circles, 168 in number, showing the very general prevalence of this disease. There are 27,247 population groups in the provinces, of which 21,497 returned fever deaths; but there are some unexplained differences in the district and town fever death-rates which appear to be related to local topographical conditions, in connection with climatic elements or to sanitary work. For example, Sambalpur district had a fever death-rate in 1881 of 8·58 per 1,000, and its previous five years' rate was 8·06 per 1,000. Ever since the introduction of registration this district has afforded similar results. It appears to be a normal ratio, of the causes of which no account has yet been given, although we have often called attention to it. In the same Mahanadi division is Bilaspur district, which registered a fever death-rate in 1881 of 25·12 per 1,000, against a previous five years' rate of 26·80 per 1,000. How happens it that these two normal rates vary so greatly? There is another district, Minar, which has a constant normal rate of about 28·20 per 1,000. It would repay all the trouble involved in an inquiry, if the climatic local and personal reasons of such facts could be assigned. But there are other ratios which have shown great reduction of late years, as for example the following :—

——	1878.	1879.	1880.	1881.
Nagpur	34·08	9·21	7·16	5·89
Betul	28·71	10·54	7·77	9·36

Nagpur town itself, with 84,441 inhabitants, had a fever death-rate of 3·58 per 1,000, and Betul town, with 4,593 people, had a fever death-rate of 5·66 per 1,000. In many towns the fever death-rates were below these numbers. We can scarcely arrive at an explanation of the facts, from the present state of the inquiry, and all that can be done is to discuss the question on general grounds, for it is quite possible that improved diagnosis might show that too many or too few deaths were classed under the fever heading, or that part of the higher rates were due to prevalence of the more severe and fatal fever types in some districts or localities.

As this matter is of considerable importance in the present state of sanitary work in these provinces, we shall give the facts bearing on it in the present report, beginning with the fever types.

13. Fever deaths in Wardah district averaged 16·46 per 1,000 in 1881, about 5½ per 1,000 under the previous five years' average. The Civil Surgeon of this district states as follows :—"In the month "of September, just after the appearance of cholera, I noticed that with many of the remittent cases "violent vomiting and diarrhœa preceded the setting in of the fever. So alarming were these symptoms "to the patients, who knew of course that there was cholera about, that the friends and relatives,

" when they applied for medical aid, usually said that the person was suffering from cholera. The " disease appeared to be modified to a certain extent by the same influences that produced cholera. " These cases, if neglected, soon passed into a typhoid-like condition, only that after the first violent " diarrhœa the bowels appeared to become obstinately costive."

In Jubbulpore district the fever death-rate was 19·27 per 1,000, against a previous five years' average of 22·38 per 1,000. The fever death-rate of Jubbulpore town, with a population of 43,223, was 16·59 per 1,000 in 1881. The Civil Surgeon describes the fever types as follows:—" Inter- " mittent, especially tertian, was the most common form. Besides these we had under treatment the " various forms of continued fever, from the mild febricula to the fatal typhoid. I cannot say that " I have seen genuine cases of true typhus. . . . Cases of true enteric fever were much more " common, every symptom being present, singling out the young for its victims, and causing death in " those who were looked upon as most robust."

This remark, be it observed, relates to the Native population.

The Civil Surgeon, Nagpur, says, "As in former years, I have seen several cases of enteric fever. " Some cases of intermittent and remittent fevers were very severe, and splenic enlargements " common." On the other hand, the Civil Surgeon, Hoshangabad, states that obstinate cases of remittent were common. " Gastro-intestinal irritation, as also congestion of the liver and spleen, were " very common concomitants of the fever; but in no case did I observe any properly so-called " enteric symptoms."

The Civil Surgeon, Minar, describes the fever as of the "common intermittent type," with cases of remittent in the hot months. Civil Surgeons in other districts testify to intermittent with splenic or hepatic complications as being the more common types.

Malarial fever types of all degrees of severity, with complications and true enteric fever cases, ending in death, include the fever problems to be dealt with by sanitary proceedings. The facts scarcely account for the great losses of life entered under the head of "fevers" in the returns, and there is hence little doubt that many fatal cases in which there co-existed febrile symptoms with other fatal diseases found their way into the returns of fever. If we make any reasonable allowance for defects in registration and errors in diagnosis, we shall still have the very important element of diversity in local death-rates to deal with, diversities which, unless otherwise accounted for, lead directly to the question of local fever causes.

14. *Bowel Complaints.*—In 1881 there were registered 22,133 deaths under this head, or 2·98 per 1,000 of the whole population. The district death-rate was 2·91 per 1,000, and the town rate 4·13 per 1,000. Bowel complaint deaths were registered in all registration circles, but in only 7,535 population centres out of 27,247. This last fact throws doubts on the records, or on the diagnosis, neither of which can be removed at present. The monthly numbers registered as deaths from bowel complaints stood as follows:—

Months.	Bowel Complaint Deaths.	Months.	Bowel Complaint Deaths.
January	1,883	July	1,850
February	1,375	August	2,465
March	1,664	September	2,329
April	2,065	October	2,047
May	1,957	November	1,833
June	1,523	December	1,642

15. Two districts in the same division presented the same anomalies in their bowel complaint and fever death-rates in 1881 as they did in past years. We may reproduce the facts for 1881, and also for five previous years:—

Districts.	Death-rates per 1,000.			
	Fevers.		Bowel Complaints.	
	1881.	5 Years.	1881.	5 Years.
Sambalpur	9·58	8·06	12·47	10·49
Bilaspur	25·12	26·80	0·46	0·61

In former years we called attention to these facts as affording points of great importance in the sanitary history of these provinces. Some inquiry was made at the time, but without any result. The subject was, however, taken up by Dr. Brake in 1877–78, who left notes of sanitary inquiries extending over a month in Sambalpur district, and covering a distance of 200 miles, in the course of which attention was especially paid to the condition of villages, habits of the people, and the condition of water-supply. Dr. Brake recorded the results in the terms which follow:—" In every town or " village visited he found that cattle were stabled at night within the house compounds on irregular " ground without drainage. Manure kept in the compounds or house enclosures certainly for " months, and in some cases seemingly for years. In no place did he see spaces outside villages set " aside for the collection of refuse, sweepings, &c. In many of the compounds, more or less filled

" with manure and rubbish of all kinds, including very offensive sour rice, the inhabitants had eased " themselves as in latrines. The ground around and close to the towns and villages was generally foul, " as were also the lands and bunds of the tanks supplying water for all purposes."

Insanitary conditions such as these would account for any amount of predisposition to bowel affections, but it may be found that similar defects exist in districts where bowel diseases are not so fatal as in Sambalpur. This point might be inquired into. But, as already stated, a high death-ratio from bowel diseases is not the whole problem requiring elucidation. This includes a persistent low death-rate from fevers as well as a high death-rate from bowel diseases. It may be suggested as possible that some of these fatal bowel complaint cases may in reality be of fever types, ending in diarrhœal states.

For example, the conjoint mortality from fever and bowel diseases, in Sambalpur district in 1881 was 21·17 per 1,000, and there are several other districts where the conjoint death-rates do not exceed, or even reach this amount. It may be, therefore, that the first step towards a solution of the difficulty in the case of Sambalpur, as well as in the Bilaspur example, may lie in improved diagnosis. This is merely thrown out as a suggestion which may be adopted in any future inquiry into the subject.

16. *Injuries.*—Death from suicide numbered 542, from wounds 2,225 and from snake-bite and wild beasts 1,190; in all 3,925, or 0·53 per 1,000 of the population.

17. Under the head of *all other causes* there were entered 60,488 deaths, equal to 25 per cent. of the total mortality of the year. In the Punjab it has been found that a considerable part of this large unclassed disease group can be separated under the head of respiratory diseases. The disease history of 1881, in the present state of registration, scarcely requires more detailed notice, and we shall next discuss the progress made during the year in sanitary work.

18. *Sanitary works* (*Civil*).—In the Central Provinces there are 72 population groups entered in the statistical tables under the designation of towns. But in reference to 19 of these only is there a return made of the municipal expenditure. Their population is about 400,000, and their income about 52,000*l*., of which 12,340*l*. was spent on conservancy. The actual cost per head of the population per annum varied from about 2*d*. to 1*s*. per head. When it is considered that cleanliness is simply a domestic duty, which every family should provide for itself, or pay for, it cannot be said that the outlay under this head was excessive. Further advances were made during the year in improving existing wells, and constructing new ones. A list is given of 48 tahsils in the districts, in 29 of which improvements in water-supply were carried out. They were limited, however, to 507 villages, only a very small proportion of the total villages in the provinces. The nature of these well improvements will be sufficiently understood from the following details. Repairs were effected in 853 existing wells, and 191 new wells were constructed. The number is very small for the population, but on the other hand this important work has been carried out year by year for many years past.

19. The present condition of the water-supply may be in some sense estimated from these facts. The returns include water sources of 23,856 villages, and these sources are as follows:—

Number of villages drawing water from:—

Pucka wells	4,567
Kutcha wells	5,691
Tanks only	4,224
Running streams only	5,260
Running streams ceasing in hot weather	3,308
Using notoriously bad water	269

For reasons which we have often stated, it is an essential condition of improved water-supply for Indian towns and villages that the immediate subsoil water be cut off from the well, so as to draw upon the deep sources only, unless new wells are formed in clean ground, and at a distance from all surface impurities. Of course it is always safer to bring good water from a distance, as has been done in the case of Nagpur, which has the great advantage of deriving its supply from waterworks executed some years ago. Mr. Brake, the Civil Surgeon, reports that the waterworks "are more " and more appreciated; every month applications are entertained from householders seeking a " special supply for their private establishments; and during the year nine new standards have " been erected, two by persons for their own use, and at their own expense, amounting to Rs 1,212, " and seven others by charitable individuals for the use of the public, at a cost of Rs. 2,177." In other towns some consideration appears to have been bestowed on the construction of waterworks, but in Nagpore alone have works been completed. There is a near prospect, however, of a similar advantage being extended to Jubbulpore, which is to receive its supply from a reservoir seven miles from the city. This work has been actively carried out, and it is to be hoped that early in 1883 the first supply will be turned into the city. The estimated cost is 60,000*l*. Khandwa and Burhanpur have water reservoirs, but there has been no water distribution, properly so called, as yet. In the former case water is raised by steam power.

It will be seen that some progress has been made in providing the larger population groups with pure water brought from a distance and distributed by pipes. For villages, the only resource is to construct wells on the principles laid down in our "suggestions," which if fully carried out would make well supplies perfectly safe for limited populations.

20. As the new local and district authorities for the Central Provinces will be in action shortly, it may be useful to give a very brief outline of works in progress in some of the districts, the sanitary defects brought to light by inspections, and the chief sanitary measures which, as shown by the facts, may be at once carried out.

In *Saugor* district many wells were cleansed, deepened, and provided with parapet walls and gratings. Many defective drains were cleansed and repaired, dry-earth latrines provided, and the sewage trenched at a distance.

In *Damoh* similar improvements in water-supply were made. "In some places magnificent "structures of this kind (wells, water sources) exist, requiring little repair, but, as a rule, neglected "and uncared for, no one being responsible for their preservation."

Jubbulpore.—"Arrangements for conservancy reported as most satisfactory. The municipalities at "Sehora and Murwara" have improved the drainage and conservancy of the towns very considerably.

Narsinghgur.—"All roadside and camping ground wells, and all others within municipal limits, "were cleaned and repaired during the year."

Birman fair was held on the 10th January 1882, and came to an end on January 24th, in consequence of intelligence of cholera having appeared at the great Mela at Allahabad. On the bathing day 60,000 people were present, the usual medical and sanitary arrangements were carried out, and there was no epidemic disease; only 22 cases of ordinary complaints were treated.

Hoshangabad.—Many new wells were made in the course of the year. Bowel complaint deaths are said to be more frequent among persons using Nerbudda water, but this fact, if it be one, admits of proof, and its reasons can also be shown. In the district villages the purity of well water is chiefly endangered by surface filth, the wells not being protected by copings. In the town itself drains and conservancy appear to be well attended to.

Nimar.—Of the Sadhr town the civil surgeon states that square sectioned drains have been in use, "the worst description that could be adopted, constantly breaking, difficult to clean, and with their "levels by no means correctly laid."

The greater part of Burhanpur has been drained. "A very fair system of removing night-soil and "road sweepings exists and these are all utilised." But "refuse water from the houses is allowed "to run into the open roadside drains, and as this is frequently mixed with urine and excreta, and as "there is no way of flushing these drains, and, further, as the drains themselves are out of level and "badly constructed, the foul water lodges and contaminates the atmosphere." In the town people still use privy wells, and attempts to introduce the dry-earth system have failed, as the people will not use the earth.

Burhanpur contains some 30,000 inhabitants. Its five years' average death-rate was 40·65 per 1,000, but in 1881 it was only 21·94 per 1,000, 10·88 of which was due to fevers.

Betul.—There appear to be no latrines in the district for want of funds.

Chindwara.—Considerable drainage improvements have been carried out. Many narrow streets have been widened and new ones opened up. Conservancy of private houses is carried out by the municipal establishment.

Seoni.—Sanitary condition of town "much improved:" filthy water holes filled up, and drains cleaned and deepened. Dry-earth public latrines in use.

Mandla.—"Water-supply abundant." Water sources in villages generally well cared for.

Bhandhara.—Lower castes, who are prohibited from drawing water from wells, use any kind of water they can get. Wells for low-caste people should be constructed.

Nagpur.—We have already mentioned the Nagpur waterworks. There is no account of any drainage arrangements, but the conservancy is fully carried out, and the dry-earth system enforced.

Wardah district.—Hinganghat waterworks approaching completion.

Chanda.—Water-supply abundant and protected from impurity. Water pipes from Ramala tank repaired; public drains repaired.

Raipur.—Trial wells yielded water with "26 per cent." of carbonate of lime per gallon, with superabundance of chlorine and albumenoid ammonia. There seems to be some mistake in reporting the analysis, but any way the water is unfit for use. Two swamps were drained. Dry-earth latrines were extended.

Bilaspur.—Drainage to be improved, but no funds available at present.

From these abstracts it will be learned that the chief improvements which have been carried out have been those connected with water-supply. This, no doubt, is a very important part of the work, but it is not all, or anything like all, the sanitary work required in these provinces.

21. In previous years the Sanitary Commissioners have no doubt described the actual condition of the many population groups, and their reports should be referred to for the facts. In the report under review are given the results of a number of inspections made by the Sanitary Commissioner himself, by the civil surgeons, and also by vaccination officers, which may be briefly condensed as follows, beginning with those sent in by the vaccinators, which are chiefly confined to describing the villages in their respective districts, of which upwards of 1,000 were inspected, notes of their sanitary condition made, and advice given as to improvements required.

These officials have received a simple training in sanitary knowledge at the Nagpur Medical School which they are required to put to useful purpose while engaged in their proper vaccination work. It cannot be expected that their estimates of local causes and their influence on health should be those of thoroughly trained sanitary officers, but, nevertheless, they are doing good work. They report a large proportion of the inspected villages as dirty, animals kept in houses or compounds, and in many instances the water-supply bad or liable to pollution. Their work, humble as

it is, may be productive of much benefit when they have had more practice in it. The Sanitary Commissioner states that, "on the whole, the vaccinators appear to have done fair work in advising "the people of the villages on matters of sanitation. . . . . There is every reason to believe "that some good has been already effected, and that the vaccination staff, if properly supervised "and kept to their work, will prove a most valuable aid in this direction, and that ultimately "substantial progress will be made in village sanitation."

22. The reports of civil surgeons were expected to give the results to health of the observed sanitary condition of improved and unimproved localities. We suggested this subject of inquiry in consequence of instances of apparent unusual healthiness in the provinces, but the civil surgeons have rather reported on the general sanitary conditions of towns and villages visited by them. A large amount of useful work was done by them in this matter, but it is unnecessary to give details, as these do not differ except in being more specific from those of the vaccinators. Many villages were found in a bad condition, and had suffered much from epidemics. Others were in a better state, but the general result of the reports is that much requires to be done before population groups in these provinces can be considered safe from epidemics.

The civil surgeon of Wardha describes four cases of fever of so unusual a type that they were considered on the spot to be a new disease. The cases occurred in a village of 96 huts situated on a mountain range. The first case was in a young man 27 years of age, who was attacked on the 3rd or 4th February 1881 and died on the 8th or 9th. The day before he was attacked he had travelled 20 miles in a cart in the heat of the day, under a temperature probably of 97° in the shade and 119° F. in the sun. He went to bed apparently well. Next morning he complained of severe headache and fever of continued type, with burning heat of skin, then followed bleeding from the nose, and vomiting of dark blood, which was also passed by the bowels, body became cold, face and whites of eyes yellow, urine in small quantity and very yellow. Insensibility with open eyes, with picking of bed clothes, took place on the third morning, and he never recovered consciousness.

The next case, aged 22, was taken ill on the 12th February and died on the 14th. This young man had been labouring in the fields the day before seizure. He suffered from fever and headache, together with constant vomiting of green and yellow liquid and subsequently of blood. There was no bleeding from the nose or bowels.

The next case resembled the first one in its symptoms. His age was 21 or 28; he was taken ill on the 14th February and died on the 19th.

The last case was in a carpenter, 28 years of age. He travelled in the heat some 25 miles on the 27th February; was taken ill on 1st March. The case went through the same stages as the first, and he died on 8th March. There were no more cases. No persons who were about the cases suffered, and, except the heat, there was no cause apparent which did not apply equally to unaffected persons.

On the 18th December 1880, a boy, four years of age, was admitted to the Mayo hospital, with no fever, bleeding from the nose, coffee coloured vomit, with blood clots, petechiæ, enlarged spleen, and intensely yellow skin; he died on the 20th, seven days after attack.

The cases were few in number, only five, and all died. There were no remissions. The fever type was not agreed on by medical officers, and we have thought best simply to give a brief statement of the facts.

23. The Sanitary Commissioner's account of his own inspections is much fuller than the accounts supplied by other officers, and he has introduced important suggestions on local sanitary measures connected with latrines and trenching, which will, no doubt, receive attention from the new local authorities.

24. These are the chief points calling for remark in the present year's report, and if, as a whole, the report is not altogether of a satisfactory nature, the cause must be sought in rapid changes of officers, and not in any want of zeal on the part of the new Sanitary Commissioner, who has obviously done the best he could under the circumstances.

25. It may not be out of place to conclude the present memorandum with a general outline of the sanitary work with which the new district authorities will have to deal, premising that it is absolutely indispensable that steps should be taken to correct the local strength of population already referred to, and to calculate per-centages of births and deaths upon the corrected numbers for every district and town. If this is not done there will be no reliable data on which to rest evidence of improved health, or to show whether local funds have been expended to the best advantage.

In the meanwhile, it would be advantageous to prepare tables showing the causes of death and the death-rates for a series of years past for every town and district, so that the authorities may at once be made acquainted with the sanitary problems with which they have to deal.

26. The great causes of sickness, death, and loss of labour in the provinces are all included under the general head of "fevers." Cholera epidemics are only of occasional occurrence, although cases may happen at any time.

Small-pox is a more constant visitant, as are also diseases classed as "bowel complaints," but all are of less importance than fevers, while in removing the local causes of "fevers" there will be a reduction in the mortality of other epidemic diseases. Fevers, as is well known, are connected with climatic causes which also influence crops, and hence means should be adopted for making local

authorities acquainted with current meteorology. But the local intensity of fevers is mainly connected with purely local defects in drainage, and perhaps still more with local insanitary conditions which influence the mortality of febrile diseases in all countries and climates. In the Central Provinces these local causes may be classed as follows:—

(1.) Filth in houses and compounds (including the results of stalling cattle in them). Surface filth in towns and villages outside houses, arising mainly from native habits.

(2.) Impure well and tank water resulting from human and animal filth being washed into tanks or wells, or finding its way by subsoil drainage from house cesspits, or from foul ground into which the wells has been sunk.

(3.) Irregular and foul earth surfaces near inhabited dwellings, water holes, old buildings, and the like, harbouring filth and water.

(4.) Absence of surface drainage in towns and villages, and allowing foul house drainage to flow over the surface; and water from higher levels passing into the subsoil under houses.

(5.) General defects in human dwellings, including damp subsoil and damp walls, and sleeping on the ground.

27. Judging from past sanitary reports, these disease causes appear to have presented themselves most frequently to the notice of inspecting officers, and no doubt they include the chief disease causes with which the new executives will have to deal. A mere statement of them ought to carry the remedies with it, but we may resume them in the following order:—

(1.) Provision of latrines, or of properly trenched and cultivated ground, should be at once made.

(2.) Some method of keeping cattle out of compounds, but still near enough for convenience, together with collection and removal of manure, should be provided.

(3.) Following on these facilities, cleanliness in houses, compounds, streets, lanes, public roads, open spaces in towns and villages, should be rigidly enforced, and all cesspits at once filled up. First provide facilities for cleanliness, and then enforce the law.

(4.) The water-supply of every population group should be looked to. New wells should be dug in new clean ground. Tanks should be cleansed and protected, or water-works laid out, of which several good examples will shortly be found in the provinces, and as soon as these facilities have been afforded, all house wells near house cesspits should be abolished.

(5.) It is a matter of prime necessity that water for domestic use brought into any population group should be drained away, and not be allowed to sink into the subsoil to increase subsoil malaria. Some provision of drainage should therefore form an integral part of all water-supply schemes.

For small population groups impervious surface drainage, led to an outlet where the drainage could be applied to agriculture, would be the best.

There are several examples of this method in use in the Central Provinces at present.

(6.) Large drainage schemes are mostly applicable to large cities, where they would be less expensive probably than partial measures. It would be worth while, however, to examine the question of drainage works in the populous cities, such as Nagpur and Jubbulpore, where large volumes of water are brought from a distance, which must be removed to a distance after use, and so kept out of the subsoil.

(7.) In all population groups water holes should be drained and filled up, and surfaces levelled, and surface drained. Where groups of houses stand on wet and damp ground, trenching or draining should be adopted.

(8.) Tree planting would afford not only a ready means of drying damp ground not admitting of drainage, but it would afford shade and pleasure to all town and village populations.

(9.) Damp floors of houses can always be inexpensively raised above the outer ground level, and the people might be induced to raise their sleeping places above the floors.

(10.) Surface drainage requires smooth well formed road surfaces with side drains to carry off rainfall.

28. Details on all these improvements will be found in the revised suggestions of this Commission for the sanitary improvement of Indian stations and their vicinity (1882).

The principles therein contained will be found applicable to sanitary works of all degrees of importance, but for the great majority of cases very simple measures, such as those we have suggested therein, for small municipal towns and villages would probably suffice.

11th June 1883.

No. 8.

MEMORANDUM of the ARMY SANITARY COMMISSION on the REPORT of the SANITARY COMMISSIONER of the HYDERABAD ASSIGNED DISTRICTS for 1881.

1. The vital statistics of these Hyderabad Assigned Districts for 1881 are calculated on the census population of the same year. But as the officiating Commissioner points out, they are still to a certain extent unreliable on account of registration errors, especially in towns, and the population of Melghat not under registration is not included.

The registered births and deaths for 1881 were obtained from the following numbers:—

	Population 1881.
Males	1,358,275
Females	1,271,743
Total	2,630,018

This is the population included in six districts, having a conjoint area of 16,062 square miles. A previous census was taken in 1867, and during 15 years which have elapsed since then, population has increased by 443,030, or about 1·46 per cent. per annum.

Population according to classes in 1881 stood as follows:—

Christians	1,330
Mahomedans	186,033
Hindus	2,405,073
Other classes	37,582
Total	2,630,018

2. The year's births were of—

Males	53,659
Females	51,262
Total	104,921

Equal to a ratio of 39·9 per 1,000. The English birth-rate, which is not a low one, is 35½ per 1,000, and before it can be admitted that Indian rates exceed this proportion we should have to be assured of registrative accuracy. Need of this is further shown by the diversity of birth-rates, which range between 46·8 and 54·1 for rural circles, and between 29·6 and 40·8 per 1,000 for towns.

3. In 1881 there died—

Males	40,930
Females	35,731
Total	76,661

The male death-rate was 30·1, and the female death-rate 28·1 per 1,000. The conjoint rate was 29·1 per 1,000. The lowest death-rate of the year, 25 per 1,000, was registered in Wun district, and the highest, 33·1 per 1,000 in Akola. The birth-rate of 1881 exceeded the death-rate by 10·8 per 1,000.

There are still some acknowledged defects in registration, but several improvements have been since introduced.

4. *Chief diseases.*—The following were registered death causes in 1881 compared with those of 1880:—

Diseases.	Total Deaths. 1880.	Total Deaths. 1881.
Cholera	1	3,404
Small-pox	39	225
Fevers	31,027	41,681
Bowel complaints	7,997	11,951
All other causes	12,661	19,400
Total	51,725	76,661

There was an apparent increase of 24,936 deaths, not far short of a third over the preceding year's deaths, which may have been partly due to better registration, but the probability is that 1881 was a year of increase of epidemic, as it certainly was of two well known epidemic diseases, cholera and small-pox. We shall state briefly the leading facts under each of these heads.

5. *Cholera.*—The following abstract gives the history of cholera mortality for the last 14 years in Berar:—

Years.	Total Deaths from Cholera.	Cholera Deaths per 1,000 of Population.
1868	5,447	2·9
1869	10,947	5·2
1870	504	0·22
1871	581	0·2
1872	1,578	0·7
1873	—	—
1874	2	0·0009
1875	22,465	10·2
1876	2,683	1·2
1877	842	0·4
1878	34,396	15·6
1879	223	0·1
1880	1	0·0004
1881	3,404	1·3

This table is remarkable for the annual differences in cholera mortality which it displays. No deficiencies in registration would account for them. They show a tendency to triennial periods subject to sudden augmentations in intensity, for which at present no reason can be assigned unless the facts be taken to show that the most predisposed part of the population are suddenly cut off, and then the disease subsides for a time.

6. Past cholera history shows that certain localities are far more liable to losses from this epidemic than are others. The facts for each of the six districts have been as follows:—

Districts.	Deaths per 1,000.	
	1881.	1868 to 1880.
Amraoti	0·7	2·5
Ellichpur	0·4	1·8
Wun	0·8	1·9
Basim	1·2	4·4
Akola	1·6	2·8
Buldana	2·8	3·4
Total	1·3	2·8

This abstract, prepared by Dr. Little, the Sanitary Commissioner, raises not a few important points in cholera history, and it might repay the trouble if some attempt were made to ascertain the reasons of these very marked differences in topographical distribution, extending as they appear to have done over so many years.

7. The next abstract shows the monthly prevalence of cholera in 1881 compared with rainfall, and with its monthly prevalence for the preceding 14 years.

Months.	Total Cholera Deaths.		Rainfall in 1881.
	1881.	14 Years.	
			Inches.
January	—	363	0·78
February	—		
March	—		
April	—	1,915	0·11
May	—	4,122	0·32
June	1	11,518	2·13
July	245	25,532	9·49
August	1,744	23,513	8·06
September	1,064	10,170	4·03
October	217	3,603	1·42
November	50	779	1·31
December	83	472	—

The period of maximum intensity of cholera appears to be very much the same in the epidemic years. The town cholera death-rate in 1881 on a population of 133,378 was 1·9 per 1,000, representing 272 deaths. The country deaths were 3,132, or 1·3 per 1,000 on a population of 2,491,640. Several towns had no cholera deaths; but in Malkapur and Akola towns the rates were very high, viz., 8·1 and 9·8 per 1,000 respectively. As already shown, all the districts yielded cholera deaths, but these were registered in 96 out of 137 registration circles. In Amraoti district deaths were registered in 46 villages, but the total villages in this district are not stated. In the remaining four districts there are 4,469 villages, of which 391, or 8·7 per cent., returned 3,024 deaths. In the

preceding table we have added the monthly rainfall for 1881. The data appear to show that in these districts the influence of want of rain, and also of increase of rain, on augmentation and diminution of cholera mortality are experienced later than in other districts of India.

8. We shall next state briefly the history of this epidemic outbreak.

In the preceding table, a single death from cholera is entered under the month of June. The patient, a Eurasian, arrived at Khamgaon, a town in Akola district, from Bhosawal, where cholera prevailed. He was seized three hours after arrival, and died on the 25th June. No other case followed this one, which was clearly an imported one.

The real epidemic began in July in the village of Anthree, in Buldana district, 36 miles to the south-west of Khamgaon, and without any connexion with the first case in that town. The patient, a Mahar boy, aged five, "was taken ill on the night of the 7th July, and died on the morning of "the 9th. The next case was of a woman living next door. She was attacked on the 9th, and "died on the 10th. The third case was also of a woman, aged 60, living at the opposite end of "the village, and it also proved fatal. The disease then spread throughout the village, and prevailed "up to the 19th August, the date on which the last attack occurred. The total number of "attacks in this village out of a population of about 170 was 69, of which 33 proved fatal." The Civil Surgeon, Buldana, who examined into the circumstances attending this outbreak, reports that "the first case was plainly indigenous, and was the first attack in the district. No person affected "with the disease had come to the village, nor had the people of the village gone to any place "where the disease was prevailing." This account is of much importance as giving the history of a pure village attack, but it was only a part of an epidemic which prevailed in Khandesh in Bombay Presidency, where 60 villages attacked in July yielded 716 cholera deaths, while, in August, 196 villages in Khandesh yielded 1,847 cholera deaths.

Buldana district marches with part of Khandesh, and no doubt was under the same epidemic conditions, while, as regards the attacked village, Anthree itself, "the sanitary state of the "village was bad, and it is stated to have been in a filthy condition at the time of the outbreak ". . . . The water-supply was abundant from wells, but surface drainage found its way into the "majority of these."

The next reported cases took place in a wandering tribe belonging to Loharra, in Amraoti district of Berar. They were 23 in number, and had returned to Berar, after having made a circuit through part of Khandesh, where cholera existed at the time. They themselves, however, stated that there was no cholera where they had been.

They arrived at Khamgaon, in Berar, all well on the 8th July on their way home. Next day, the 9th, one of them, a woman, was taken ill and died on the 10th, but the medical officer who saw the case said it was not cholera. Another of the tribe was taken ill with cholera in Khamgaon, and was carried to a village, Ambikapur, 11 miles distant, where he died. In this village another of the party, a boy, was attacked, and recovered. The man died on the 12th July at Ambikapur, but, on the 11th, cholera had broken out in the village, and lasted till 5th August. The population was 991, and they yielded 23 attacks and five deaths. In Khamgaon town, cholera broke out on the 24th July, and ceased on the 29th August, after causing 98 deaths out of a population of 8,472. It is stated that there had been no communication with the sick of the tribe at this town (there was only one case in the tribe, which was removed before death).

Cholera did not break out in any village through which the wanderers returned home for a month afterwards. The next outbreak took place in a group of villages, 42 miles from Ambikapur, the nearest infected locality. It appeared on the 12th July, the same day the wanderer died in Ambikapur. One of the attacked places, Malkapur, is situated on a line of railway in daily communication with Bhosawal, where cholera was prevailing, but the Civil Surgeon states that "the earliest cases in Malkapur clearly occurred in people who had no communication with "Bhosawal or with affected persons from that place."

The first case reported in Amraoti district was that of a Bunniah, who had been to Punderpore fair, in Poona district, whence he travelled by rail through a cholera infected locality. He arrived at his home on 20th July, and died on the following day. The day after his death, a woman in the village was attacked and died in a few hours, and three others, who recovered, were attacked in the same house, with this woman. The sanitary state of the village was bad, "cattle "and poultry shared the dwelling-houses with their owners," and there was no drainage.

These cases refer to the first appearance of cholera in districts in Berar; several others are given of a similar character, but the districts themselves are very small areas within a region where cholera prevailed epidemically. The first registered death took place in Akola district, one of the six districts into which Berar is divided in June 1881. In July four of the six districts were attacked. In August, September, and October the whole six districts suffered. In November four of them yielded deaths, and in December two. August was the month of maximum mortality. The cases of presumed spread by communication were carefully examined, but from the results arrived at they appear to have been simply part of a moving epidemic which covered part of Bombay Presidency at the same time as it did Berar.

The disease appeared in Khandesh, in Bombay Presidency, in March, and attacked a single village, where 11 cases proved fatal. In May another village was attacked, and yielded seven deaths. In June, when the first death was registered in Berar, two villages were attacked in Khandesh, and yielded 59 deaths. In July, the epidemic extended over both Berar and Khandesh. In the latter

district, in Bombay Presidency, 60 villages were attacked in this month, and 716 deaths were registered; and in Berar 237 villages yielded 245 deaths from cholera in July. There was nothing in the facts to justify a recommendation of one Civil Surgeon, that the moving tribe of beggars should have been placed in quarantine, or that any influence could have been exerted by any similar procedure on the course of this epidemic.

9. The history of cholera in Khamgaon town was carefully reported on by Mr. Steinhoff, medical officer, who states, "that immediately preceding the advent of cholera there had been an unusually "large number of cases of diarrhœa, colic, and indigestion treated at the dispensary." The first fatal case was that of the woman belonging to the wandering tribe already referred to, which, however, was not true cholera. Nine days after this case, on the 18th July, cholera broke out simultaneously in five different quarters of the town and quickly spread. It lasted in all 34 days. There were 313 cases and 98 deaths. Dr. Little sums up the history of cholera progress in the Berars, as follows:—"The disease did not spread from one centre. In every district almost the "first cases were in villages at a distance from large centres of population and main lines of "communications."

As has been already shown, a remarkable feature of cholera epidemics in Berar is the very great variations in annual death-rates. Climatic and local conditions remain, no doubt, much the same from year to year, and without any assignable cause an epidemic which sweeps off upwards of 34,000 people may be followed two years later by a single death. It would appear from the facts already given that time is probably an element in bringing about predisposition to attacks of cholera, that is, on the supposition that the cause is constant, or else that the cause itself, whatever this may be, is liable to great variations in intensity. So far as information on the subject is supplied by this report the usual insanitary local conditions were met with by Civil Surgeons in all places where cholera was severe.

10. *Small-pox.*—Deaths from this epidemic disease were registered chiefly in Akola district, where 196 deaths out of a total mortality of 225 took place. One district, Basim, escaped entirely. The disease was limited to 25 registration circles out of 137, and in four out of five attacked districts all the deaths, 219 in number, were returned from 74 villages out of 3589. Of registered deaths 104 took place in children under one year of age. The death-rate of the year was 0·1 per 1,000 of the population, or just one twelfth part of the preceding five years' ratio.

Berar is one of the Governments in which much good vaccination work has been done, especially in children, and we may here introduce the following totals of a table given by Dr. Little in which annual small-pox deaths are compared with the ratio of vaccinations to births for a series of years:—

Years.	Small-pox Deaths per 1,000.	Ratio per Cent. of successful Vaccinations to total Births.
1869	3·6	24·6
1870	6·63	15·2
1871	0·20	29·2
1872	3·8	53·5
1873	3·8	58·5
1874	0·5	41·6
1875	0·4	58·5
1876	0·2	63·7
1877	2·9	77·6
1878	2·7	81·1
1879	0·03	71·9
1880	0·02	72·8
1881	0·10	—

This table yields several important facts in small-pox history. It shows first a tendency to biennial epidemics. Secondly, that during the latter half of the period in this table, small-pox death-rates have fallen to one half what they were in the earlier half, and that the proportion of vaccinations to births has about doubled during the last six years of the period. Next year's experience ought to furnish important facts in small-pox history. Besides recurring biennial epidemics it will be seen that the last of these was less severe than the previous one, and if 1882 shows a recurring epidemic of less force than any preceding one, we shall have adequate proof, not only that vaccination diminishes current mortality from small-pox, but that it does so during epidemic periods as well as during times of low epidemic intensity. Any way the table affords proof that great attention has been paid of late years to vaccination, and that there has been a coincident falling off in small-pox mortality.

11. It is worth while to introduce the following facts regarding Basim district, which escaped small-pox altogether in 1881. During six years following and including 1869, the annual percentage of vaccinations to births was in round numbers 45·6, and the annual small-pox death-rate was 2·14 per 1,000 of the population. In the six following years the vaccinations to births averaged 88·8 per cent., and the small-pox deaths were 0·65 per 1,000 of the population, with the rate disappearing altogether for one year, 1881, at least.

We must, however, wait for further experience.

The monthly incidence of small-pox, mainly made up of deaths in Akola district was as follows :—

Months.	Small-pox Deaths.	Months.	Small-pox Deaths.
January	3	July	35
February	9	August	11
March	29	September	5
April	19	October	2
May	38	November	3
June	43	December	28

Akola district yielded nearly 90 per cent. of the year's mortality, and its average percentage of vaccinations to births for the last six years has been 55½, or 33 per cent. under the Bassim rate. It is necessary to state the facts.

12. *Fevers.*—Diseases registered undes this head were returned from every registration district, and from every circle. The number of villages registering fever deaths was not returned for Amraoti district, but in the other four districts fever deaths were returned from 3,380 villages out of 4,469. As usual, every month in the year yielded fever deaths, as is shown by the following table in Dr. Little's Report, which also gives the chief climatic elements in comparison with the mortality :—

Months.	Mean Temperature.			Rain Inches.	Fever Deaths.
	Max.	Min.	Range.		
January	69°·07	56°·4	20°·4	—	2,526
February	88·3	62·1	26·1	0·01	2,449
March	71·8	65·7	21·5	1·19	2,564
April	100·9	74·8	26·1	0·17	2,966
May	104·0	77·9	26·1	0·42	3,284
June	90·0	72·6	17·4	12·49	2,148
July	82·8	70·4	12·4	13·68	2,795
August	81·4	70·4	11·0	10·22	4,587
September	83·9	69·6	14·3	4·20	5,387
October	66·0	65·9	21·1	2·37	4,750
November	81·2	57·8	23·5	0·96	4,263
December	80·8	53·4	27·3	—	3,963

On the supposition that these data are close enough approximations for practical purposes, they afford information of importance. They show clearly that, in Berar at least, high temperature ranges do not rank immediately as fever causes, for the highest fever death-rates were by no means coincident with the highest ranges, but rather the contrary; consequently they show that neither high temperatures nor low temperatures rank as efficient fever causes in Berar. The one climatic element which takes the lead as a fever cause is cumulative rainfall. Heavy rain coming over a dry subsoil does not produce fever. The rain must fall in sufficient amount to water-log the ground, and it must have time to do so, and then when rain begins to fall off and evaporation to take its place, not only is there the action of malaria, but of falling temperature and increasing temperature ranges also, and fever mortality rises. When rainfall decreases in the latter months of the year temperature range appears to come into operation.

13. Of course, in any discussion about fever causes, allowance must be made for the present condition of death registration, because in Berar, as in other Indian districts, "many of the deaths "registered under that head were due to other diseases, such as measles, bronchitis, and pneumonia, "where fever was a prominent symptom."

Still the deaths took place, and they were apparently influenced as to number by climatic causes, and admitting this fact, the fever deaths would nevertheless form the great bulk of the mortality. "Dr. Little tells us that the fever itself is of "malarious origin," that the type is intermittent and "remittent, more especially the latter, and that in fatal cases brain or lung complications early set "in." Moreover, that "this year's experience further goes to prove that, (*a*) these so-called malarious "fevers are endemic, (*b*) that they are influenced and chiefly dependent upon heat, moisture, and "rapid alterations of temperature, and (*c*) that they are not communicable."

Those suffer most who are "ill-fed, ill-clothed, and who sleep on the damp ground. . . . .

"The Natives themselves recognize the effect of cold in producing fever, and they also attribute it "to a great extent to bad water, and particularly to the water of streams flowing through *sendi bunds*.

"(groves of date palm)." If the registration were altogether reliable, the following annual deaths would give the law of fever recurrence in Berar:—

Years.	Fever Deaths.	Years.	Fever Deaths.
1868	10,936	1875	26,076
1869	12,917	1876	39,875
1870	23,023	1877	34,453
1871	18,125	1878	85,260
1872	31,853	1879	32,475
1873	19,242	1880	31,027
1874	26,732	1881	41,681

During the last seven years of the series registration appears to have been better attended to, the fever-rates are higher than those of the previous seven years, and they show also the influence of scarcity of food during 1878.

14. The lowest district fever-rate of the year was in Buldana district, namely 13·7 per 1,000, and the rainfall in this district, 26·20 inches, was less than in the others. The highest fever death-rate, 21 per 1,000, was in Wun district, where the rainfall reached 44·11 inches. Referring to this fact the Sanitary Commissioner remarks that "in the Wun district the villages use charpoys for sleeping "on to a very much greater extent than in any other district of Berar, yet the fatality from fevers "is always highest in this district." This apparently exceptional result may possibly be due to local conditions of surfaces and subsoils, but it may also depend in part on the law of rain distribution, for, if the mass of the year's rain in Wun falls just before the time of increase of fever in other districts, Wun may suffer to a greater extent from this cause. All such exceptional cases merit investigation, because they may throw important light on sanitary work. But it must also be borne in mind that a great part of fever mortality everywhere, and especially in Indian towns and villages, is due to aggravation of fever cases by purely local causes in and around dwellings.

15. *Bowel complaints.*—Diagnosis of bowel complaints is still in an unsatisfactory condition, but there appears to be a nearer approach to accuracy in this matter in Berar than in several other parts of India. There were 11,951 deaths registered under the heading in 1881, equal to a death-rate of 4·5 per 1,000, as against a previous five years' ratio of 6·5 per 1,000. All the districts registered bowel complaint deaths, as did also 130 registration circles out of 137, but the usual anomaly is presented of these deaths occurring among a limited number of population groups. Deaths are returned by villages in four only of the districts containing 4,469 villages, and bowel complaint deaths were registered in 1,416 of them. It is important to contrast the ratios between the different districts side by side with the fever death-rates on account of a similar relation existing between them as takes place in the Central Provinces.

16. The following abstract gives the average ratios for a period of five years:—

Districts.	Death-rates per 1,000 5 Years.	
	Bowel Complaints.	Fevers.
Amraoti	6·7	20·7
Ellichpur	7·4	22·3
Wun	1·3	23·1
Basim	5·0	14·2
Akola	11·2	23·1
Buldana	5·0	17·6

* Wun district presents ratios between bowel complaints and fevers the reverse of those in Sambalpur district in the Central Provinces. In Sambalpur the problem has been to determine the reason why bowel complaints are so fatal, and in Wun the problem is to determine why there are so few of these deaths. In 1881 bowel complaint deaths in Wun were only 0·6 per 1,000, while the fever deaths were 21·1 per 1,000, the highest district rate of the year. Perhaps some light might be thrown on the figures by further inquiry.

17. The following were the monthly deaths from bowel complaints for the whole province in 1881:—

Months.	Deaths.	Months.	Deaths.
January	584	July	1,045
February	595	August	1,989
March	618	September	1,969
April	595	October	1,383
May	669	November	1,034
June	508	December	1,962

So far as these data are reliable, they appear to show that the same climatic and local causes which augment fever mortality during the last six months of the year influence in a similar manner the death-rates from bowel complaints.

18. *Injuries.*—Under this head were included—

Suicides	181
Wounding	38
Accidents	578
Snake-bite and wild beasts	222
Total	1,019

19. *Other causes.*—Under this very unsatisfactory title were registered 18,431 deaths, or 7 per 1,000 of the population. The ratios of these unknown diseases varied in 1881 between 2·1 per 1,000 in Wun district and 11·4 in Bassim. The facts are their own best comment.

20. *Sanitary Works, Civil.*—Under this head is given a brief sketch, with tables, of sanitary improvements carried out in municipal towns and districts during 1881. The municipal towns are Amraoti, Akola, Khamgaon, Ellichpur, and Basim. The Municipal Act has been applied to another town, Shegaon, but had not come into operation. The aggregate population of the first five towns is 90,912, and their expenditure for sanitary purposes in 1881, stood as follows:—

	£
Conservancy	2,193
Drainage	137
Water-supply	254
	£2,584

or 6¼*d.* per head.

Not much real work could be done for this sum, but it was nevertheless a quarter of the total income of these towns.

Amraoti is said to be fairly drained, but the drainage scheme remains to be completed. Cesspits still exist, which are cleansed periodically by municipal direction. A water-supply scheme is under consideration. Conservancy was less effective from falling off in supervision. Some repairs were made and ruined sites cleared. The death-rate of this town on a previous five years' average had been 21·3 per 1,000, and in 1881 it was 21·5, both rates apparently below the real rates.

The population of this town is 23,550. Public health can never be considered as properly cared for so long as cesspits and defective cleanliness exist in it.

Akola town has a population of 16,614. There is something radically bad in its sanitary condition, for its death-rate on a five years' average had been no less than 51·3 per 1,000. In 1881 the death-rate was 39·3, and this rate presented the anomaly of including 9·8 per 1,000 from cholera, and only 5·3 from fevers. It had, moreover, an unassigned death-rate from all other causes of 22·7 per 1,000.

This town has no drainage. But there is abundance of water from the river Morna, which has been improved in quality by filter wells.

Conservancy appears to be provided for, and the sweepings are sold for manure. Night-soil is collected by latrines, public and private, and removed for burial.

Diagnosis of death causes requires improvement in this town. Inquiry should be made into the causes of its very high death-rates. A survey of the town was being made for draining it, but apparently some examination of houses and compounds would reveal the reasons why so many die out of so small a population.

Khamgaon town has a population of 12,390, and a death-rate in 1881 of 31·6 per 1,000. Out of 392 deaths 96 were due to cholera.

The town was still undrained, although a drainage survey had been completed. Some masonry drains had been laid down. A water-supply scheme has been sanctioned, and waterworks were soon to be commenced.

Conservancy appears to be attended to, so far as outside surface cleanliness is concerned, but only one public latrine had been erected, which, however, had proved so complete a success that more were to be provided. Some wells have been repaired, and some new ones provided, but until house wells and cesspits are abolished, and the compounds kept clean, conservancy work will be partial and incomplete.

Ellichpur has a population of 26,782. Its five years' average death-rate has been 43·9 per 1,000, and in 1881 the rate was 29·8 in total absence of cholera. This town is undrained, and waste house drainage runs into *mories*, which are emptied occasionally.

Water is laid on to part of the town by pipes and hydrants, and the remainder is supplied from the river and wells. Water pipes and water distribution will, however, be extended all over the town when funds are available. But in this, as in all cases where special water-supply is brought into a town, it is absolutely necessary to provide drainage for its removal after use, otherwise added water will become in time an added disease cause. There is surface conservancy, but, so far as the houses are concerned, the latrines are not attended to by the municipality, and there are no public latrines.

This town requires its water-supply to be connected with its drainage, and, if possible, all the sewage should be applied to agriculture, house cesspits and house wells should be abolished, and the municipality should see to the cleansing of houses and compounds.

Basim.—Population, 11,576. This town yielded a five years average death-rate of 48·4 per 1,000, which had fallen in 1881 to 19·9 per 1,000, a somewhat doubtful figure. It is drained by side cuttings, into which house water runs, or it passes into cesspits. Conservancy of surface is provided for, but the whole place requires improvement in drainage, water-supply, and in houses.

21. Besides municipal towns, all villages with more than 5,000 inhabitants are classed as towns for registration purposes, and in the larger population groups more attention has been paid to sanitary work than in smaller villages. Excluding the municipal towns, a sum of about 10,926*l.* was allotted in 1881 for improvements in villages. Of this amount 1,700*l.* went to civil stations, 4,482*l.*, to non-municipal towns, and 2,753*l.* to villages. Of the total amount spent in this way, 2,464*l.* went for conservancy, 1,158*l.* for drainage, and 3,016*l.* for water-supply. A list of above 350 items on which the money has been laid out is given in the report. These include local conservancy arrangements, improvements in wells, new wells, and water-supply, works of surface drainage, tree planting, &c.

Considering the smallness of funds, the list shows a large amount of useful work done in the course of the year; but, as the statistics show, much more work requires to be taken in hand.

22. Under the head of *general remarks* some information is given as to the condition of villages and village work. The native superintendents of vaccination continue to inspect villages on their vaccination tours, and the Sanitary Commissioner considers that these inspections have been of great utility, and have proved conducive to more careful registration of births and deaths. Every village patel has been furnished with a copy of village sanitary rules. "In some villages attention is paid to "these, but in many they remain a dead letter." Dr. Cuningham's "Sanitary Primer" has been introduced into all schools, and distributed among vaccination officers. Water analysis has been carried out at Akola and Ellichpur, and the report concludes with an account of the sanitary state of a number of towns and villages which has brought to light the usual insanitary results of absence of proper drainage works, defective supervision of conservancy, doubtful water sources, and spending of money on certain objects which might have been better spent in other directions. For instance, in the case of Akola, there stands the following recommendation:—"To reduce the cost of the "municipal office establishment, in order to provide funds for sanitary work." There also appears to be laxity in carrying out the existing sanitary law.

23. On these practical administrative points there are some useful remarks in the letter of Mr. Howell to the Secretary for Berar, and also in the proceedings of Government on this report. Mr. Howell calls pointed attention to the fact that, notwithstanding all the reporting which has taken place, there has been so little practical action on the part of municipal authorities. He says, "It seems also to be forgotten, especially in India, that reporting is not an end, but a means to an "end, and this end is work actually done or to be done." We are afraid that this censure is pretty generally applicable. If the sanitary executive had been as active as the sanitary reporting officer, improvements would have proceeded at a very different rate than they have done. Mr. Howell meets the customary excuse of poverty in the following words, which every executive sanitary authority in India should bear in mind:—"The excuse for this neglect is want of funds, which, if "it were true, is invalid, because it is the business of municipalities to raise funds for the primary "and essential purpose of sanitation;" and he goes on to show that a proper system of sewage trenching may not only be self-supporting but remunerative, and that it is most important that the towns should place themselves in such a position as to sanitary work, that they might afford examples to be followed by country people visiting them.

24. As to the villages themselves, there is a passage in the Government resolution which appears to us to be of much practical importance, and we may quote it. Mr. Trevor, the Secretary, says, "If Government officers made it a rule to make the patel of every village they pass through, or "encamp at, produce his sanitary code, and to ascertain how far it had been acted up to, the idea "that sanitation is an object of real anxiety to Government would soon spread, and cases such "as Dr. Little refers to, when patels forget that they have codes, would be unknown."

25. These two official statements sum up the practical results of Dr. Little's very interesting report, and we have only, in conclusion, to express our concurrence in the principles they enunciate, and our hope that the sanitary administration may be so systematized in both towns and villages that the mere reported fact of the existence of removable insanitary conditions may lead to their being at once dealt with. After so many years of reporting, fresh complaints become of the nature of indictments against all persons entrusted with local powers for improving public health.

13th June 1883.

No. 9.

Memorandum of the Army Sanitary Commission on the Report of the Sanitary Commissioner for Assam for 1881.

1. The census population of Assam for 1881 amounted to 4,815,157. But excluding the hill districts into which registration has not as yet been introduced, the eight districts furnishing returns of some kind contained at the date of the 1881 census a population of 4,483,705 affording an increase during the preceding ten years of 679,489. If both enumerations were trustworthy, the law of increase would be for the entire population about 1·9 per 1,000 per annum, a result rather proving that the population of 1871 had been in all probability under-estimated, at least when we take into account the sanitary condition of the population which presents itself in the present and in preceding reports for the province.

2. The population furnishing vital statistics in 1881 is thus not the total population of the province, but that of the following eight districts, six of which have also in this the first year of the new decade supplied births as well as deaths:—

Districts.	Population, 1881.	Births.		Deaths.	
		Total.	Per 1,000.	Total.	Per 1,000.
Goálpára	446,232	6,143	13·77	5,855	13·12
Kámrúp	644,960	11,180	17·33	9,614	14·91
Nowgong	310,579	8,602	27·69	7,363	23·71
Darrang	273,333	5,270	19·28	5,565	20·38
Sibsagar	370,274	9,334	25·20	7,215	19·48
Lakhimpur	179,893	2,204	12·25	2,044	11·36
Sylhet	1,969,009	—	—	32,274	16·39
Cachar	289,425	—	—	1,991	6·87
Total	4,483,705	42,733	19·20	71,941	16·04

The deaths amounted to 71,941, equal to a death-rate for the whole population under registration (namely 4,483,705) of 16·04 per 1,000. But the 42,733 births and their ratio of 19·20 per 1,000 were derived from a population of 2,225,271, or a little more than one half of the population yielding the deaths. The death-rate and birth-rate taken over the population yielding both ratios in 1881 were:—

	Per 1,000.
Births	19·20
Deaths	16·93

or between two and three per 1,000 increase of births in the year over the year's deaths.

The registration is improving, and further steps were being taken in this direction at the close of the year.

3. The following numbers of deaths were registered under the usual heads in 1881:—

	Deaths.
Cholera	5,010
Small-pox	3,129
Fevers	42,553
Bowel complaints	9,865
Injuries	934
All other causes	10,450
All causes	71,941

With the exception of diseases classed as "bowel complaints," there was a large increase of mortality under all the headings, while the total deaths exceeded by 20,275 those registered in 1880; but this fact indicates better record, and not necessarily increased death-rate.

4. There was little special in the year's disease history, as the following brief summary will show:—

Cholera.—The death-rate from cholera was 1·12 per 1,000 of the total population: mortality from cholera was highest in low lying, wet, and damp districts on both sides of the Bramahputra river. The Sanitary Commissioner has given an excellent map of Assam, on which the relative prevalence of cholera is shown by colours, and from this it appears that all districts within which the cholera mortality was at or above one per 1,000 were riverside districts, and that elsewhere the rates were about one half this amount.

Cholera deaths were reported from 201 out of 389 circles of registration, and from 620 villages out of 17,355. But the number of the attacked villages does not include those in Sylhet, so that excluding all the Sylhet villages, of which there are 6,380, there would remain 10,975 villages, in 620 of which there were 3,554 cholera deaths.

The facts afford an additional illustration of an established law of epidemic cholera in India, namely, that whether the disease covers a larger or smaller area of country, the attacks are strictly local, pointing directly to the need of local sanitary measures.

In the districts for which data were available, the proportion of attacked villages was about 5·6 per cent., but in the three most severely affected of these districts, Kamrup, Nowgong, and Sibsagar, the proportion of villages which suffered rose to 8 per cent., affording another illustration of a great general law of epidemic cholera, that its death-rate depends in most cases on the number of points attacked.

5. There was a great difference in cholera mortality among the district and town populations. In the former the census enumeration gave 4,425,692 inhabitants, among which there were 4,716 cholera deaths, equal to a death-rate of 1·07 per 1,000. In eight Sadr towns there were 294 deaths from cholera out of a conjoint population of 58,013, affording a death-rate of 5·07 per 1,000. Of these towns, Gauhati, with a population of 11,695, yielded 216 cholera deaths, or 18·47 per 1,000, the highest local rate of the year.

6. The cholera invasion of the two great valleys of Assam presented the following striking seasonal differences :—

Months.	Registered Cholera Deaths.	
	Brahmaputra.	Surma.
January	74	496
February	20	131
March	10	173
April	74	282
May	113	176
June	398	16
July	440	53
August	418	62
September	322	9
October	485	5
November	655	4
December	540	54

There were apparently two distinct and separate epidemics in these valleys, having no relation to each other. There is too little information available on the comparative meteorology of these districts to enable the influence of this important element to be arrived at. But the following remarks of the civil surgeon on cholera in Sylhet, included in the second column of the abstract, are important. He says, "Looking back to my notes for the last six years, I find it has invariably "happened that as soon as the country becomes dry cholera makes its appearance, and remains till "the inundations set in." He explains that during the rains "the district is practically converted "into an archipelago, and epidemic cholera is rarely heard of." But, "with the dry season come "reports of cholera from every direction. They are almost simultaneous from every point of the "compass. It springs up like a plant of the season. Its progress," he says, "cannot be mapped "out and traced from place to place, like a cholera epidemic in the North-west provinces."

We have here then perfectly trustworthy evidence that there is a large district of Eastern Bengal subject to high rainfall and to flooding where cholera cannot exist so long as the flooding continues, and it follows that exposed earth surface and local climatic influences are necessary conditions to the appearance of cholera, and that this is a different matter altogether from moving cholera, and the losses occasioned by it. But the facts suggest a whole line of inquiry as to whether the appearance of cholera at successive points up the Ganges valley is not coexistent with conditions of surface and subsoils favourable to its appearance, which reproduce at successive points away to the north-west the conditions necessary to the existence of the disease as the season and climate advance, rather than actual movement of the epidemic?

This is simply made as a suggestion, which, if found to be true, would throw light on some obscure parts of cholera history, and reduce its complicated phenomena under the same law which governs its origin in what is called the "endemic area."

7. A table is given in the report to show the relation between rainfall and cholera in five thanas, including Nowgong, where the rain was registered, of which the following are the monthly totals:—

Months.	Rainfall at Nowgong. Inches.	Deaths from Cholera.
January	0·06	41
February	0·64	6
March	3·12	5
April	5·42	15
May	6·95	4
June	18·35	122
July	18·89	217
August	15·49	78
September	13·88	54
October	0·61	18
November	0·05	140
December	—	30

Rainfall generally influences the amount of cholera in a district at dates subsequent to increase or decrease in amount of rain, and the fact can be best shown in monthly divisions, rather than by quarters of years, which tend to obscure the relation between the events. Taken on the quarters, as has been done in the Report, the relation between rainfall and cholera is not very evident, but, as the preceding abstract shows, low rainfall is followed (not accompanied) by great increase of cholera mortality, while high rainfall is followed by decrease of deaths, which again increase after falling off of rain. We suggested long ago the use of a daily register of rainfall, and cholera mortality which would afford the most accurate means of comparison.

8. But whatever may be the influence of flooding and subsequent water subsidence on the outbreak of cholera, in certain districts of Assam, or of rainfall on its monthly history, the present Report, although not professing to give a sanitary account of affected localities, nevertheless contains information to show that local causes, with which alone it is possible to grapple, played a very important part in augmenting the death-rates. For example, it is stated of one thana, Roha, "that "the people live surrounded by every conceivable insanitary condition. Their huts are low and "damp and badly ventilated, and often so densely surrounded by jungle as to exclude both air and sun. Refuse matter of every description rots near their dwellings, and their water-supply, which probably never pure, is not unfrequently directly fouled and polluted."

The Civil Surgeon states that no precautions are taken when cholera appears, and that the same condition of things existed in nearly all the villages he visited.

Local damp or wet ground, local filth and its consequences, foul well and tank water, appear to be the principal determining causes of cholera in Assam. Death still takes place from it among coolies in the tea gardens, but there are no statistics available as yet for these establishments. The Medical Officer states, however, that the coolies are now provided with better water, and more comfortable houses. But, "except on tea gardens, no changes likely to prevent an outbreak of cholera or lessen "its severity have been made. The villages are filthy in the extreme, and in many of them there is "no water except that obtained from drains and shallow mud wells, so that when next we have an "epidemic we may expect a repetition of 1879."

9. We are glad to see that the Deputy Commissioner has requested that the Civil Surgeon should visit the larger villages and examine into their sanitary state, in order that any suggestions he might make might be carried into effect by the Deputy Commissioner.

This is a very important matter, but it must be borne in mind that, so far as local epidemic causes are concerned, "the cholera water theory," which has done not a little to prevent the progress of sanitary work, does not cover all the ground even in the flooded regions of Assam. The fundamental cause of cholera, so far as concerns locality, is filth, without which, no foul water could exist even in Assam, and no remedy would be found for this filth, even if none but distilled water were given to the people. Provision of better water, or rather the protection of water sources from surface and subsoil filth, is a matter of urgent necessity, and must form an essential element in the sanitary improvement of every Assam town and village. We have shown how this can be don in our "Suggestions," but it would be an unfortunate mistake to leave out the drainer and scavenger from the work. All this is better understood now than it was a few years ago, when a short road to the management and prevention of cholera was sought in this water theory.

10. *Small-pox.*—As already stated, small-pox deaths during 1881 numbered 3,129, of which only 47 took place in the Sadr towns, equal to a death-rate on their population of ·81 per 1,000. The rate for the whole population was ·69 per 1,000. The following were the monthly deaths:—

Months.	Small-pox deaths.	Months.	Small-pox deaths.
January	154	July	365
February	202	August	285
March	316	September	209
April	474	October	137
May	297	November	162
June	349	December	185

The relation of these deaths to temperature is shown by the observation, that the highest daily mean temperature beginning with 70·13° F. in April, and rising to 87·14° F. in July, and thence to 83·43° F. in September, included the period of highest small-pox mortality. The coincidence is generally observed in India, and appears to point to climatic elements as among predisposing causes of small-pox there.

Inoculation is stated to be still a common practice and a cause of extension of small-pox. There are no means of accurately comparing small-pox deaths with vaccination operations, as the vaccination report is separately published, and besides the Chief Commissioner in his review points out that the sanitary and vaccination reports "are not synchronous, but relate one to the calendar, the "other to the official year," an anomaly which may advantageously be corrected.

If, however, we take the data in the vaccination report for 1881–82 as they stand, and compare them with the small-pox mortality of 1881, we arrive at the following results, beginning with the vaccination staff:—

Civil Surgeons	12
Hospital assistants	34
Vaccinators	31
„ municipal	6
Ex-inoculators	·96
Total	178
Primary vaccinations	39,128
Of these successful	34,698
Successful re-vaccinations	1,118
Total successful operations	35,816
Small-pox deaths 1881	3,129

11. *Fevers.*—Deaths from "fevers," 42,553 in number, represented a death-rate for the entire province of 9·49 per 1,000, probably under the truth. The lowest registered rate was 4·32 per 1,000 in Cachar; the highest 14·39 per 1,000, was registered in Darrang. Taken separately, the country rate was 9·51 per 1,000, and the town-rate 7·76 per 1,000. When compared with other regions of India, the fever death-rate of Assam is not high. The following abstract shows the monthly incidence of fever during 1881:—

Months.	Fever deaths.	Months.	Fever deaths.
January	3,058	July	3,590
February	2,465	August	3,235
March	2,488	September	3,567
April	2,515	October	4,503
May	2,920	November	5,272
June	3,178	December	5,772
Six months	16,614	Six months	25,939

The months of lowest fever mortality were February, March, April, and May, which together yielded 10,383 deaths, or a fourth part of the mortality.

The remaining three-fourths took place in months which had climatic peculiarities connected with heat and rainfall, and with sudden falls of temperature and the occurrence of fogs.

Excess of moisture, or rather of water, appears to be unfavourable to the production of fever. The Civil Surgeon at Lakhimpur states that such is the case in his district, and that fevers are of intermittent type chiefly, and usually tractable.

Remittent is comparatively rare, but enlarged spleen and malarial cachexy occur. In Goalpara district there is a tract of country on the north bank of the Brahmaputra where the Deputy Commissioner states "there is hardly a single inhabitant, and it is said that this tract has been "depopulated by malaria." Fevers in this district are most fatal at the base of the Garo Hills. In Nowgong district, where the fever death-rate averaged 12·66 per 1,000, the last three months of the year showed the greatest mortality, which, the Civil Surgeon reports "is easily accounted for by the "fact of heat and wet acting on heaps of filth collected in villages and producing poisonous vapours, "the influences of which the people in an already enfeebled state are unable to withstand."

There is nothing unusual in the fact of this year's experience of Assam fevers. They all tend to show that village improvements in water-supply, drainage, cleansing and jungle clearing, will have to be carried out, before we can expect reduction in fever death-rates.

12. *Bowel complaints* caused 9,865 deaths, or 2·20 per 1,000 of the population. The highest recorded death-rate was in Sibsagar district, namely, 4·21 per 1,000. Although the nomenclature and registration are still defective, the monthly deaths under this head, chiefly diarrhœa and dysentery, present the following features, which are well worth inquiry:—

Months.	Bowel Complaint Deaths.	Months.	Bowel Complaint Deaths.
January	663	July	768
February	475	August	677
March	438	September	957
April	544	October	1,184
May	802	November	1,241
June	806	December	1,310

It will be observed that the death-rates follow no regular course in the first eight months of the year, but that a rapid rise occurs on and after September.

The rates differ greatly also in different parts of the country. Sibsagar, as already stated, yields the highest rate, and it appears to be persistent, pointing to some special causes in the localities.

The lowest bowel complaint death-rate, ·57 per 1,000, took place in Cachar.

13. *Injuries.*—In the year 1881 there were 74 deaths from suicide, 670 from wounding and accident, and 250 from snake-bite and wild beasts. There is nothing in the facts calling for special remark, so far as practical remedies may be required, for the details are not given.

14. The only matter in the section on disease history which appears to call for remark is the following passage, which may be noticed, not for the purpose of interfering with the individual opinions of the Sanitary Commissioner, but simply to state that such views are unnecessary in sanitary reports made in the public service:—"For, though epidemic disease requires a special "contagium to produce it, surrounding conditions must have a potent influence in its development. "Over the production of contagia, or the special viruses of disease and the influences of the weather, "we have no control, but we have complete control over the insanitary conditions in which people "live, and experience has abundantly shown us that, under the presence of the contagium of an "epidemic, a foul atmosphere, bad drainage, cesspools, and putrefying refuse matter may push that "contagium into the virulent energy of reproduction. These conditions, then, are all removeable "causes, but too frequently they become the potent distributors of disease and death. Our "immediate and earnest attention is required to one common remedy, namely, to general and more "efficient conservancy of the soil, air, and water in every town, and, as far as possible, in the larger "villages in this province. The early removal of putrefactive matter from around and from within "dwelling-houses before it can split up into foul and unwholesome gases, the supply of a pure and "unpolluted water for domestic purposes, the clearing of dense jungle and undergrowth from "around the houses of rural and urban communities, more efficient drainage, better constructed "houses, with the view of teaching the people to sleep off, and not on, the damp floors of their "cottages—the cottage or hut itself should be raised on piles."

We have often advised the adoption of these improvements, and we entirely concur with the Sanitary Commissioner as to the practical conclusions at which he has arrived, but we cannot see how their necessity is made more evident by introducing "contagia" into his very clear and useful summary of work which must be done. If this speculative matter is introduced at all, it must lead logically to far other measures than these. It follows that, in the present state of our knowledge, it is better to keep clear of hypothetical disease causes, and to limit our work strictly to practical inquiry and observation, and, by doing so, we shall avoid another not unfrequent error of ascribing an epidemic or endemic seizure to a solitary speculative cause, where observation showed that the causes were many. At all events, there ought to be no difficulty in acting on the principle that, whether disease "germs" exist or not, the practical work must be done.

15. Under Section IX. (Sanitary Works, Civil) a brief statement of improvements carried out in 12 towns, unions, &c., is given, but the expenditure has only been returned from 10 of them. The total amount expended for all public health purposes, including roads and medical relief, in these 10 localities, was 3,769*l.*, of which 583*l.* was for drainage, 166*l.* for water supply, 854*l.* for conservancy, and 1,778*l.* for roads and conservancy. Not much in the way of sanitary work could have been done for this sum, and the notes on the localities themselves show this to have been the case. Sanitary work is only being begun in Assam.

16. Under the head of "General Remarks" the Sanitary Commissioner states that, of 8,213 coolies embarked at Dhubri for the Brahmaputra voyage, two died of cholera and 12 from other causes. The death-rate for the voyages, the average duration of which is not stated, would thus be 17 per 1,000, showing that disease causes which were in operation in previous years had diminished in intensity. There was, in fact, less cholera than usual, and the Sanitary Commissioner adds a caution "that, while this report is being written, there is already a foreshadowing of outbreaks of "cholera as severe as those experienced in previous years." We have had occasion, in several of our previous memoranda, to deal with these river outbreaks among coolies, to whom they were almost entirely confined. They were attributed at first to bad drinking water, but this has been corrected. It has not been shown that cholera on these voyages has been due to exposure or to bad diet, or to local infection, although cholera often exists as an endemic on both sides of the river. The only remaining cause apparently is the one we have discussed in previous memoranda, namely, that the coolies bring cholera predisposition on board with them, to be developed into activity by conditions on board ship. If this view be correct, the cause must be traced back, as we formerly pointed out, to the depôts, and it is possible that careful medical inquiry might show that cholera cases had been embarked in the diarrhœal stage. At all events great care requires to be exercised over the sanitary condition of the depôts and the surrounding localities. The health condition of coolies at the port of embarkation is reported as exceedingly good, but this does not preclude the possibility of predisposed cholera cases being put on board.

17. It is satisfactory to learn that the sanitary management of the tea gardens is being improved. This is stated on the personal testimony of the Sanitary Commissioner as follows:—"I visited many "tea gardens in Upper Assam, that is beyond Dibrugarh, on the line to Sadiya, and I was much "pleased with the general care which I saw bestowed on tea garden coolies, especially in several "instances on the weakly and sick. The general butting of the coolies, the water-supply in many "of the tea gardens, showed marked signs of improvement, and on many of the better class of "gardens I met with indisputable evidence of the kindly treatment bestowed by managers themselves

" on the tea gardens' labourer. . . . That an unmistakable movement forwards, towards the " improvement of the health status of the garden coolie throughout Assam has been made during the " past few years there can, I think, be no doubt." This experience is confirmed by other reporters. More attention has been paid during the last two or three years to hutting, drainage of lines, providing good water, and more suitable diet, cleanliness, and the cultivation of fruits and vegetables; but still from one district, Cachar, we have the following startling fact that " on only two gardens in " 1880 was there a mortality over seven per cent.," which, be it observed, is the death-rate of a great pestilence. No doubt there has been improvement even in Cachar, but it would be a matter of no small interest for sanitary purposes if we could be informed of what nature was the management which rendered such a death-rate possible. Unfortunately, there are no statistics regarding these rates, and, until the true figures are supplied to the Sanitary Commissioner, no reliable opinion, either as regards causes or remedies, can be given.

18. During the year the Sanitary Commissioner made numerous inspections in both of the great valleys of Assam, and his tour extended over 2,127 miles by land and water. He again refers to the interruption of his work, by having been called away by the Commander-in-Chief, in his capacity of head of the Military Medical Service. No doubt this is one of the disadvantages of the late changes, but it may be possible to obviate any injury to the civil branch by a little arrangement made beforehand.

19. Appendix A, on the utility of *amchur* as an anti-scorbutic, and the appendix on dispensaries, belong to administrative matters. The first comes under the Medical Department, and Sir A. Home has advised that a twelve-month's trial be given to the remedy among Native troops. The dispensary administration is not within our province.

20. In conclusion, the present report should be considered as a continuation of the report of 1880. The two together give a good general idea of the Assam sanitary problem, which is made up of several elements.

The climate is a wet or damp one, with seasonal fogs. The ground and subsoils are wet, and subject to water-logging or flooding. Evidence appears to show that the very excess of water in the low flat districts of the valleys is, to a certain extent, unfavourable to the rise of epidemics, but that the dry or drying-up season is the period of greatest epidemic prevalence.

But, besides these unalterable conditions, there are abundant local disease causes due to the habits of the people themselves, and it is to these and their eradication that sanitary effort may in the meantime be most effectually directed. They have been so well summed up by the Sanitary Commissioner that it is unnecessary to do more than advise strongly that the practical examinations of villages directed by the Chief Commissioner should be efficiently made, and local schemes for their improvement drawn up and carried out. A further important step in sanitary progress would be to try the introduction into Assam of the Burmese practice of building houses on piles. It is satisfactory to learn that sanitary improvements have been introduced into the tea gardens; but some steps should be taken with those gardens where such excessive rates have prevailed as are stated in this report. It would be for the benefit of all parties that such rates should be improved off the face of the earth.

In our suggestions for the sanitary improvement of India stations and their vicinity, we have laid down the principles on which village and town improvements should be carried out.

12th June 1883.

No. 10.

Memorandum of the Army Sanitary Commission on the Report of the Sanitary Commissioner for British Burma for 1881.

1. The total population of British Burma, according to the census enumeration of 1881, is given by the Chief Commissioner as 3,736,771, being 29,125 in excess of the number adopted in our memorandum on the report for 1880. In certain remote and comparatively inaccessible hill tracts registration has not yet been attempted, and leaving out the population of these districts, there remains a population in which registration is more or less successfully effected of 3,692,263, including—

Males	1,968,029
Females	1,724,234

2. The registered births on these numbers in 1881 were—

Males	38,012
Females	35,742
Total	73,754

The total registered birth-rate was 19·98 per 1,000 of the population, a ratio considerably under the truth, as is shown by the fact that birth-rates in districts vary between 13·55 and 33·18 per 1,000.

3. In the same population the deaths were, of—

Males - - - - -	31,966
Females - - - - -	26,170
Total - -	58,136

yielding a death-rate of 15·75 per 1,000. The death-rates, like the birth-rates, varied in different districts between 8·88 per 1,000 and 28·20 per 1,000.

Registration has been attended with considerable difficulty, and even in its present defective state it is the result of much work. The ratios, such as they are, give little useful information, but there is no help for this defect except in time and persistent effort.

Registration of deaths is much better carried out in towns than in country districts. The average death-rate of 1881, taken over a population of 414,529 living in 18 towns, was 27·43 per 1,000, the ratios lying between 14·36 per 1,000 (very nearly the district average), which was the lowest registered rate, and 48·76 per 1,000, which was the highest. These contrasted facts would appear to show that, with suitable registration machinery, it might be possible to arrive at better district results.

4. *Causes of death.*—Where the general registration has shown these defects, not much reliance can be placed on diagnosis of death causes, or in the proportion of deaths assigned to each cause. Such as they are, the facts are as follows:—

Diseases.	Total Deaths.	Deaths per 1,000 of Population.
Cholera - - - -	5,239	1·42
Small-pox - - - -	1,766	0·48
Fevers - - - -	27,143	7·51
Bowel complaints - -	3,808	1·03
Injuries - - - -	523	0·14
All other causes - -	19,057	5·16
Total - - -	58,136	15·75

We shall discuss briefly the year's disease history under each of these heads.

5. *Cholera.*—Cholera death-rates were apportioned between town and country populations in the following ratios:—Towns, with their population of 414,529, yielded 658 deaths, equal to 1·57 per 1,000 of the population, while the country deaths, among a population of 3,277,734, were 4,581, affording a cholera death-rate of 1·40 per 1,000. Two of the towns, Mergui and Tounngoo, escaped cholera, while two of the districts in Arakan division also escaped. There was a very general diffusion of the disease in 1881, but the attacks were confined to 97 circles of registration out of 875 in the provinces, and all the deaths were returned from 222 villages out of a total of 15,451.

The following abstract gives the monthly incidence of cholera in 1881:—

Months.	Cholera Deaths.	Months.	Cholera Deaths.
January - - -	417	July - - -	1,452
February - -	139	August - - -	1,634
March - - -	105	September - -	212
April - - -	296	October - - -	61
May - - - -	346	November - -	69
June - - - -	285	December - -	293

The figures in this table cannot be well understood without reference to the corresponding data for 1880, which were as follows:—In that year there were two outbursts of cholera, and the maximum number of deaths during the first of these was in January, and amounted to 163. The mortality then declined rapidly, until in August only one death took place. But in the next four months the deaths were 91, 602, 887, and 634 in December, from which month of 1880 the epidemic passed over to January 1881, which yielded 417 deaths as already shown, and the subsequent history of cholera during the latter year is given in the table.

6. The intensity of cholera varied greatly in different divisions of Burma. For example, in the three districts of Arakan, out of 3,335 population groups only five in Akyab district yielded 18 cholera deaths. The death-rate for Akyab was 0·05 per 1,000, while its previous five years' average rate had been 6·78 per 1,000. The highest district death-rate of the year was that for Thayet-Myo, which reached 7· per 1,000. Generally the river-side divisions yielded the highest rates. The town of Thyet-Myo itself yielded a death-rate of 4·78 per 1,000, while the rural part of the district had a rate of 7·34 per 1,000. On the other hand the towns of Yandown and Pantanaw had cholera rates of 6·79 and 7·29 per 1,000, while the rate of Thonegwa, the country within which they are situated, was only 1·39 per 1,000.

Rangoon, the capital city, with a population of 134,176, had only 72 cholera deaths, or 0·54 per 1,000

7. A new year has removed from Burma a newly-appointed Sanitary Commissioner, who has been replaced by another newly-appointed officer, and it is probably to this cause it is due that no sanitary account of cholera is given in the present year's report. It affords another instance of the disadvantages attending frequent changes in the sanitary administration under recent arrangements, which ought to be met by some better apportionment of duties. We feel assured that when Government sanctioned the union of medical and sanitary duties under one inspecting officer, no such result was contemplated.

8. That there may have been localizing causes sufficient to account for much of the loss of life from cholera had they been looked for, may be inferred from the following facts about Dala, in Rangoon, detailed by the Civil Surgeon, who states as follows:—"In the course of an inquiry into the cause of "the epidemic at Dala, and the influence of neglected sanitation, and foul wells, tanks, and streams "on the health of the adjacent population, it was found that that influence is everywhere concealed "by the presence of nuisances of a much more obvious and decided nature. Among these there is "one nearly universal, the injurious effect of which overpowers that of all others, viz., the retention "of house refuse, and every abomination in the way of filth, close to, and indeed sometimes under-"neath, their dwellings. The condition into which the systematic retention of such filth brings "the whole of that part of Dala occupied by the poorer classes is probably not generally known. ". . . . In one group of houses, when cholera prevailed, the water was got from a filthy tank "and a dirty stream close by. The waste water is thrown in front of the house, or oftener through "the bamboo flooring of their huts to the ground beneath; a fluid, several inches deep, accumulates; "into this are thrown all sorts of house refuse, possibly sometimes excreta and urine, with which is "at length formed a semi-fluid mass of putrifying animal and vegetable matters, disgusting in "appearance, and giving off a most offensive smell. Of the very large numbers thus seen, not one "was found in a satisfactory condition, but the description above given, with slight modification, "sometimes a little for the better and sometimes for the worse, would apply nearly to the whole of "them."

Of course, with such a state of matters at Dala or anywhere else, one would expect cholera when an epidemic was about. It is a solitary example given of the year's experience, and we must make the best of it by asking why such a thing is allowed to exist. Somebody must be to blame for it. First afford to the people facilities for keeping their houses, water sources, and surroundings clean, and then see that they do it. This is the simple practicable rule to be applied in this and similar cases.

9. The Sanitary Commissioner mentions another outbreak of cholera which took place between 18th November and the 1st December in the lunatic asylum, appearing and disappearing suddenly, and he asks, "If the outbreak at Dala was the result of deficient sanitation, or rather no sanitation "whatever, what shall we say to this epidemic which suddenly broke out in one of the best cared "for institutions in Rangoon? The lunatic asylum is kept scrupulously clean, the latrines are in "the most perfect order, and the inmates kept in seclusion from the outer world, and yet here "cholera suddenly makes its appearance and as suddenly ceases."

The reply, so far as facts enable a reply to be given, may be as follows:—When an epidemic of cholera is in a district within which lunatics are kept, these, partly from the necessary restrictions under which they are placed, are liable to cholera, and, in some cases, the only remedy might be found in their removal. And admitting this liability, which apparently exists, it by no means follows that the sanitary state of the asylum as described above would be sufficient protection to its inmates. Large space, free circulation of air, pure water, suitable food and clothing, all enter within the domain of preventive measures in asylums, as well as cleanliness, and what would be sufficient in these matters in ordinary times would not necessarily be so when an asylum was in the midst of an epidemic.

10. We shall conclude this statement about cholera with the following facts, to show the necessity for dealing with the disease on distinct practical principles. The Sanitary Commissioner says:—"A most extensive and fatal epidemic of cholera prevailed in the town and district of Thyet-Myo "from the end of April to the close of the year. The total number of deaths in the town was "95, and in the district 1,234 died." Surely here was a case in which the local medical authorities ought to have given some information as to the localising causes of the pestilence, and what was done for them. This is what is said about it:—"There is no evidence to prove the disease was imported, but there is every likelihood of this being the case." Where was it imported from, and why was it there to be imported? Is it too much to ask that loose opinions of this kind should be avoided in sanitary reports, which are of no use unless they form the basis of practical action.

11. *Small-pox.*—In 1880 there were 5,402 registered deaths from small-pox, while in the year under review the mortality had fallen to 1,766. There has been a reduction of small-pox mortality from a previous five years' death-rate of 1·01 per 1,000 to 0·48 per 1,000 in 1881. This disease was very generally diffused over the province in 1881. Deaths from it were returned from all the 15 districts, with two exceptions, both in Tenasserim division. But the disease showed its presence only in limited areas within the districts, for out of 848 registration circles in 13 affected districts only 64 were attacked. In the same 13 circles are 14,960 villages, and all the deaths were returned from 87 of these. Small-pox in 1881 was endemic, and showed little tendency to diffuse itself over the adjacent country. The highest district death-rate was in Henzada, which yielded a ratio of 1·51 per 1,000. Out of 18 towns 12 yielded deaths. The highest rate was that of Kyaukgin, 11·37 per 1,000. Generally the town death-rate exceeded the country rate in the proportion of 1·33 to 0·37

per 1,000. Of the total deaths, 1,766 in number, 1,027 were registered in males and 739 in females. There were 342 deaths in infants under one year of age, and above half the year's mortality took place at ages under 12.

12. It is not easy to give a connected history of small-pox in a country having such various climatic and topographical conditions as Burma, and in the present state of registration, because all the factors are not in our possession. Using such information as we have, we find that in the first eight months of 1880 there were 5,027 small-pox deaths registered, and in the last four months only 375. The months of highest mortality were March and April, and the deaths in October had fallen to 61. In November 68 small-pox deaths were registered, and there was a sudden increase to 150 deaths in December 1880, passing onwards into 1881, as is shown by the following abstract, which gives the monthly incidence of small-pox during the latter year:—

Months.	Small-pox Deaths, 1881.	Months.	Small-pox Deaths, 1881.
January	224	July	96
February	330	August	52
March	368	September	53
April	315	October	8
May	145	November	16
June	107	December	52

These monthly numbers for the whole province represent approximately the monthly ratios in different divisions. So far as can be judged of, small-pox in Burma declines in autumn to increase in winter, and to attain its maximum in spring.

13. The vaccination establishment for the official year 1881–82 was made of—

Superintendent General	1
Superintendents of circles	16
Superintendents of circles, Native	3
1st class vaccinators	16
2nd class vaccinators	29
Servants	2
Total	67

The year's work consisted of 39,844 successful vaccinations and re-vaccinations. 11 per 1,000 of the population were successfully vaccinated, and 0·48 per 1,000 died of small-pox.

But against 39,844 successful vaccinations must be placed 73,754 registered births, or 19·98 per 1,000. The first figure must be accepted as correct, the last represents about half probably of the real births. Any way the figures show how large an extent of ground must be covered by the vaccinators before the births are dealt with, leaving out the unvaccinated adult population. The average cost of each successful vaccination was 8 a. 5 p. The total establishment charges were 2,108*l.*

14. *Fevers.*—The same difficulty exists in Burma as in India in the diagnosis of death causes usually attributed to fevers. The Sanitary Commissioner states that the "Burmese call all illnesses in "which there is an elevated temperature of the body by the common name of fever," while medical officers concur in opinion that Burmah is not specially a malarial country. Dispensary returns for 1881 give the outdoor and indoor patients for that year at 121,796, and of this number ague and remittent fevers yielded 18,632, or a little over 15 per cent. But taken on the febrile group this proportion is much higher, for besides true malarial fevers, about which there could be no doubt as they were seen at the time, there were admitted 148 cases of small-pox, 136 of cholera, and 299 of all other febrile diseases. There were, however, 4,095 rheumatic cases, which might come under febrile conditions in their course, but any way there was a large number of purely malarial fevers treated. We concur in opinion, however, with the Sanitary Commissioner that some simple means might be tried to separate true fever deaths, and perhaps the method he suggests of adopting paroxysmal symptoms as tests in place of the heat test might help to solve the difficulty.

15. There were, as has been already shown, 27,743 registered fever deaths, or 7·51 per 1,000 of the population against a previous five years' annual average of 9·07 per 1,000. Fever deaths were registered in all the 15 districts of the province, and in 564 out of 875 registration circles, but only in 1,436 villages out of 15,451, or under 10 per cent. This single fact throws doubt on the whole fever question, and shows that there are either too many or too few deaths registered from this presumed cause. We can only deal with such data on the subject as the report contains, and the following table gives a monthly abstract of fever deaths.

Months.	Fever Deaths.	Months.	Fever Deaths.
January	2,617	July	2,656
February	2,290	August	2,915
March	1,933	September	2,679
April	1,991	October	2,327
May	1,812	November	2,186
June	2,236	December	2,111

This abstract, when compared with similar Indian tables, would appear to show that these Burmese data afford rather a fair monthly average registration under the fever head, than the monthly mortality from a class of diseases peculiarly influenced by season and climate. The registered fever death-rate for country areas was 7·28, and for towns 9·31 per 1,000.

16. On the assumption that death registration in Hanthawaddy district, within which Rangoon town is situated, is fairly accurate, we have the means of comparing the fever deaths within this district with rainfall and humidity as registered at Rangoon, but unfortunately the temperature maxima, minima, and ranges are not given, only the means. The following are the data:—

Months.	Fever Deaths.	Rainfall. Inches.	Humidity.
January	328	—	50
February	327	—	44
March	259	—	48
April	245	—	51
May	188	14·17	74
June	223	17·23	89
July	272	30·30	89
August	283	17·72	90
September	280	15·17	85
October	259	4·21	83
November	238	2·99	71
December	285	0·08	74

It cannot be said that in the district of Hanthawaddy there is much apparent relation between rainfall and fever. The monthly fever deaths appear to point to the action of constant topographical causes. In a former memorandum we suggested that an inquiry might be made into the relation of subsoil water and fever prevalence at Rangoon, with the view of obtaining some information as to the reasons of those great diversities in fever death-rates which prevail over different Indian river deltas. In the Irrawaddy delta water is found at depths from 6 to 17 feet, and usually below water level in the river. The subsoil is usually sand, with bands of clay and laterite intersecting it, and there is no evidence that the subsoil water flows in the direction of the river. It may be stated in this connexion that the last five years' average death-rate from fever in Hanthawaddy district was 8·66 per 1,000. It seems not unlikely from the facts that the Burmese resist the action of malarial fever causes much better than the Hindoos, and they no doubt derive advantage from sleeping above the ground level. It is stated in the report, indeed, that fever cases admitted to hospital are chiefly of remittent type, and mostly from among natives of India. Fever death-rates, nevertheless, vary greatly in different regions of Burma, and are highest in three Arakan districts, where the rainfall is also highest, and where it exceeds 200 inches per annum on an average of these districts.

17. *Bowel complaints.*—Diseases registered under this head show the usual anomalies in distribution. Deaths from them were returned from all the 15 districts of the province. There are 875 circles of registration, but only 134 of these registered bowel complaint deaths, while the total number of deaths, amounting to 3,808, took place in 179 villages out of 15,551. These facts show how little confidence can be placed in the registration in some parts of the country at least.

The monthly prevalence of bowel complaints was as follows:—

Months.	Bowel Complaint Deaths.	Months.	Bowel Complaint Deaths.
January	334	July	556
February	212	August	574
March	200	September	412
April	236	October	228
May	277	November	181
June	360	December	238

On comparing these monthly data with those given in the preceding cholera table, it will be seen that the monthly increases of the two diseases resembled each other, and that both declined after the increase of rain, as shown in the abstract fever table given above.

18. It is unnecessary to make any remark on the remainder of the year's disease history, and the report contains very little information on the sanitary state of places where deaths from epidemic diseases were registered.

19. *Sanitary works (Civil).*—Under this head are given a few details of sanitary proceedings, but they convey information chiefly about works in progress, or which are to be undertaken. We shall give a brief abstract of the facts under the most populous localities.

Rangoon.—The capital of Burma had a population on the census of 1881 of 134,176. Its death-rate on a five years' average had been 34·13 per 1,000, which had fallen in 1881 to 27·28 per 1,000, and of this ratio 9·73 per 1,000 was attributed to fevers. The town is situated on low ground with little fall for drainage, on the delta of the Irrawaddy, and, like all low-lying towns, it required from the commencement of sanitary work much labour and considerable outlay to remedy the consequences of past neglects, as well as to provide for the future.

The following statement taken from the Government resolution on the present report will show the existing condition of sanitary improvement in Rangoon:—"In Rangoon the waterworks will be "completed in two years, and water will then be laid on throughout the town. The scheme will "not, however, be complete until filter beds are provided to purify the water. The Chief Com- "missioner has promised a provincial grant, equal to half the cost of these filter beds; so important "does he deem the filtration of the water supplied to the city and shipping at Rangoon. A scheme "of drainage has been proposed, and meanwhile a good deal of money has been spent in repairing "and reconstructing the drains already in existence. Some good work has been done in raising and "clearing the back drainage spaces, which have long been a disgrace to the town. It is to be "hoped that the sanitary need of Rangoon will receive constant and careful attention at the hands "of the elected committee shortly to be constituted there."

In regard to current work, the Sanitary Commissioner states that upwards of 5,000*l.* have been sanctioned for constructing new and repairing old drains on account of dilapidation and accumulation of "fœtid sewage" in the hollows. Wherever drains of this type are used, they must be durably constructed, with proper gradients and material, and have water currents flowing through them to prevent deposits. But "a complete drainage scheme for the removal of night-soil has been approved "by the municipal committee, and will be undertaken on the completion of the waterworks, if funds "be available." Lake water had been brought into the town, but waited distributing arrangements. The principal roads had been raised with earth and metalled with laterite. A fish-market with marble slabs, water-taps, and a constant water-supply had been provided.

Up to the present time it appears that much good sanitary work has been done in Rangoon, and we hope it will make progress under the new municipal authorities.

29. *Akyab town* has a population of 33,980. It had a five years' average death-rate of 40·54 per 1,000, and in 1881 of 27·74 per 1,000. No work of any consequence for improving the public health was undertaken.

The sum of 1,247*l.* was spent on day conservancy. There is no removal of sewage, but "the "grand work of the municipality during the season has been the almost entire completion of the main "bazaar, at a cost of something like 1,200*l.*" This is no doubt a useful work, but if the town had been drained and supplied with water, the bazaar might have had drainage and water, both of which it is in want of at present.

21. *Prome.*—Population 28,813. Five years' average death-rate 42·66 per 1,000. Death-rate of 1881, 34·67 per 1,000, of which 4·30 was due to cholera.

This town was inspected by the Sanitary Commissioner, who states that the great source of sickness is the annual inundation, which leads to general disturbance of the surface, deposit of decaying substances, and injury to the water-supply. The chief sanitary requirements are stated to be good drainage, which is being proceeded with.

A bund to prevent inundations, closure of cesspits, and thorough night conservancy.

A good supply of pure drinking water. Wells are brackish, and not to be depended upon.

Surface drains had been partly introduced, and conservancy was more or less attended to.

22. These illustrations may be sufficient to give a general idea of sanitary problems in Burmese towns, which are being dealt with by works of a simple character. The towns situated on rivers appear to be more or less subject to floods, which leave stagnant water and deposits after they subside. In other towns excessive rainfall leads to similar results, which, however, are minimized by native habits of house construction. So far as can be judged of from the reports, sanitary proceedings must mainly lie in good surface drainage, and in improving natural watercourses and outfalls to get rid of surface water as quickly as possible; equalizing surfaces with the same object; abolishing cesspits to prevent pollution of the ground; abolishing bad wells, and providing better sources of water-supply; rigid attention to cleanliness, thinning rank vegetation near dwellings to allow of free perflation of air; these measures, together with banking out floods, appear to include the chief improvements required for the smaller class of towns and for villages. Works of a more complete kind, such as those being carried out for Rangoon, take time and outlay, and much useful experience will no doubt be obtained from Rangoon works in future.

23. Assuming that the simple surface work mentioned in the reports is of a kind to remedy the evils, there has been much of it done already, and the result to health, so far as the death-rates enable an opinion to be formed, have been that the aggregate town death-rates, which, on a five years' average, had been 30·71 per 1,000, had fallen in 1881 to 27·43 per 1,000, which is only a shade above the rate of Rangoon, where most of the sanitary work of the year has been done, at least where it has been carried out on the largest scale.

24. We learn from the Government "Resolution" that "at Akyab and Moulmein no important "sanitary works have been carried out. Akyab was without an engineer for the greater part of the "year, and at Moulmein want of funds has hitherto prevented the execution of any comprehensive "scheme of drainage or water supply. At Prome, sanitary works were energetically carried on, a "complete drainage scheme had been sanctioned, and the works are in progress." Other sanitary works are also in hand. "At Bassein 7,000 feet of brick drains were constructed during the year; "the reclamation of a great part of the Athehgyee swamp was completed. Cesspits are being "rapidly superseded by a more rational system (of public latrines). Water-supply schemes are "being prepared for both Prome and Bassein. In Toungoo the municipality expended Rs. 23,295 "on sanitary works. . . . . At Henzada Rs. 97,000 were expended on sanitary works, the "most important being the construction of brick drains." In the smaller towns little progress has been made; but it is a noteworthy fact that at Yandoon the people themselves had combined to

introduce night conservancy. Elsewhere, however, "the cesspit system is universal." The Government further state that "a translation of Dr. Cuningham's Sanitary Primer, altered, so as to specially "adapt it to Burma, has been prescribed as a school text book, and copies of the work are being "distributed as widely as possible throughout the province." The object of this is to spread information, and to induce the people, especially in country villages, to improve their sanitary surroundings. "Meanwhile, district officers should lose no opportunity in encouraging and assisting "the people" in this work. "In many places the adoption of a simple system of drainage, and of a "few obvious and inexpensive precautions for protecting well water from contamination, would "effect a great improvement in the healthiness of a neighbourhood. The people should be "encouraged, as far as possible, to carry out such works themselves." All this is as it should be, and the only suggestion we would make in conclusion is that civil surgeons and vaccinating officers might usefully employ themselves in giving effect to these instructions of the Government, so far as they have time at their disposal. The Burmese people are a far more practical race than the Hindoos, and might be induced to act on advice given them, especially if backed by the new municipal authorities, whose attention might, with advantage, be called to the great importance of sanitary work, the nature and principles of which will be found fully stated in our revised "Suggestions" for the improvement of Indian stations and their vicinity, printed in 1882.

19th June 1883.

No. 11.

MEMORANDUM of the ARMY SANITARY COMMISSION on the RAJPUTANA SANITARY, VACCINATION, DISPENSARY, and JAIL REPORT for 1881.

1. This report, as its title implies, is a summary of a year's useful work rather than a Sanitary Report. It is similar in character to the Report noticed by us in our Memorandum printed in the India Office Sanitary Reports for 1880, and all that we propose to do with it is to give a brief abstract of the sanitary data which it contains, in the hope that these details may be given in greater fullness in after years.

2. The census of 1881 has not been as yet made use of in calculating the rates for the year, and as there has been an increase of population since the previous census of 1876–77 amounting to 56,744 for Ajmere and Merwara, and 1,691,238 for the Native States, the birth and death ratios for 1881 are too high.

The population for 1881 was returned as follows:—

Ajmere	453,075
Native States	11,005,512
Total	11,458,587

Facts regarding birth and death-rates at all reliable, are attainable only for Ajmere and Merwara, but there is no registration properly so called in the Native States.

3. In Ajmere and Merwara districts there were registered in 1881 the births of—

Males	6,915
Females	5,876
Total	12,791

or in the ratio of 32·27 per 1,000 of the population of 1876–77. But on the population of 1881 the birth-rate would be 28·2 per 1,000.

4. The deaths registered in the same districts in 1881 were as follow:—

Males	6,029
Females	4,720
Total	10,749

giving a death-rate of 27·12 per 1,000 on the previous census population, but a ratio of 23·7 per 1,000 on the population of 1881. In dealing with death ratios of circles and towns we must, however, accept the ratios of the census of 1876–77, and we have not the circle population for 1881.

5. There are five towns in Ajmere and Merwara which had an average death-rate in 1881 of 26·43 per 1,000, calculated on a population of 73,225, which is a shade lower than the general death-rate. The lowest town death-rate was 20·47, the highest 34·69 per 1,000. Of 18 country registration circles, the lowest death-rate of the year was 13·28 and the highest 40·27 per 1,000. It is worthy of remark that this highest rate took place in the rural circle of Nusseerabad, where British soldiers have suffered so much from enteric fever in times past.

6. The following were the chief registered death causes in 1881 :—

Diseases.	Total Deaths.
Cholera	16
Small-pox	1,603
Fevers	6,510
Bowel complaints	1,910
Injuries	183
All other causes	1,427
All causes	10,749

The cholera of 1881 was a purely endemic outbreak at Ajmere. The town of Ajmere yielded 5 deaths, the suburbs 10 deaths, the Ajmere rural circle 1 death; 16 in all. There was 1 death in the suburbs of Ajmere in June, 2 in the town and 1 in the rural circle in August, 3 in the town and 7 in the suburbs in September, and 2 in the suburbs in October. The civil surgeon states that "no two cases occurred exactly in the same neighbourhood, and no common use of drinking water "could be found amongst them."

No account is given of the state of the houses or their vicinity, where these cholera deaths took place. Has this defect in the information arisen from the absence of observed local causes, or from looking only in the direction of cholera poisoned water for a reason for this outbreak?

It is worth while to put the question, and to ask for a report on the state of the houses and their surroundings. The acting sanitary officer should keep in mind that, in dealing with the causes of cholera, opinions are of no use, and that facts regarding locality are what are wanted for practical purposes.

7. *Small-pox.*—The small-pox mortality presents one curious feature. All the 1,603 deaths of the year except 7, took place in the country circles, and those 7 deaths took place in three towns out of five. The provincial small-pox death-rate was 4·04 per 1,000, while the town death-rate was 0·09 per 1,000.

The history of small-pox in 1881 connects itself with the outbreak of 1880 as follows. There were 5 deaths in October, 66 in November, and 113 in December, and the monthly deaths in 1881 were :—

Months.	Small-pox Deaths.	Months.	Small-pox Deaths.
January	147	July	49
February	215	August	17
March	331	September	19
April	470	October	10
May	238	November	12
June	64	December	41

The spring months were those of highest mortality.

The total successful vaccinations in Ajmere and Merwara, which yielded these small-pox deaths, were 4,388 primary vaccinations and 45 re-vaccinations.

In the whole of Rajputana, including the Native States, the successful vaccinations amounted to 89,583, and the successful re-vaccinations were 253. The percentage of successful vaccinations was 90·42. In Ajmere and Merwara each successful case cost 36 pies, and in Rajputana 23 pies.

8. *Fevers.*—The following was the monthly incidence of fever mortality in Ajmere and Merwara districts:—

Months.	Fever Deaths.	Months.	Fever Deaths.
January	617	July	363
February	586	August	558
March	577	September	824
April	592	October	619
May	418	November	525
June	319	December	512

and the following was the rainfall in 1881 as compared with the previous six years' average :—

Years.	January to May.	June to September.	October to December.	Total.
	Inch.	Inch.	Inch.	Inch.
1881	1·37	19·43	0·40	21·20
Six years' average	1·70	21·47	1·45	24·62

These amounts of rain do not account for the high fever mortality up to May. There seems to have been a period of drying up, succeeded in June by heavy rainfall, followed in September and afterwards by a second period of evaporation, during which the mortality rose.

9. There is nothing more of importance connected with fever history of the year except the varying death-rates in different localities, which lay between 5·75 per 1,000 and 30·79 per 1,000 in 1881. A similar diversity is shown by the preceding five years' averages, the lowest of which was 8·36 per 1,000, and 33·77 the highest. It is worthy of remark that, during the whole six years, the lowest rates we have given were returned from the same rural circle, Jawala, in Merwara district, and the two highest from Pisangan town, in Ajmere. The facts, and others of the same nature, point clearly to the existence of purely local fever causes.

10. *Sanitation.*—Under this head are some points worthy of notice. Ajmere town, with a population in 1876–77 of 31,583, had nearly completed its water-supply. Filtering beds and reservoirs were in the course of construction, and it was expected that water would be distributed by pipes throughout the city "in October next." By this time, therefore, the water-supply should be in operation. But there were difficulties about the sewage question, arising from fear of failure in the amount of water in the lake, which on a former occasion had become nearly dry. The point under discussion was the possibility of removing sewage by hand labour and carts for trenching. In relation to these questions it may be well to recall the principles to be kept in view, leaving the decision to the municipality.

Water has been introduced into the town, and is certain to become an added disease cause unless provision of some kind be made for the removal of all fluid sewage and waste water produced. There are only three ways of doing this, either by providing for the careful collection and removal of as much of the water with the domestic sewage as can be kept out of the subsoil and carting it to a distance for manure, or by introducing house drainage arrangements, with closed drain pipes, to remove the sewage to a distance and apply it to agriculture, but for this there must be sufficient water. Ordinarily household water is enough for drainage purposes, but it is always safest to have separate means of flushing out lines of pipe sewers; or special arrangement should be made for collecting house sewage for removal, and then forming a system of impervious surface channels for removing the refuse house water to a distance.

The point to be aimed at is to keep the subsoil pure, and to remove as much of the water-supply of the town after it has been used as can be collected.

11. In the Native States, movement in the direction of sanitary works and measures is taking place in many parts, and in some towns drainage appears to have been provided. The chief measures relied on are, however, cleansing and prevention of nuisance, and to assist in this work a circular, originally prepared by Mr. Maconaghey, in the North-West Provinces, has been printed and circulated. The directions "have done some good directly in a few instances, and indirectly in "other cases, by drawing attention pointedly to the subject of sanitation."

It is not necessary to reproduce the circular, as we noticed it with approbation in a former memorandum. It prescribes daily cleansings, prevention of nuisance within 200 yards of villages, removal of insanitary trades, protection of drinking water, weekly reports on the state of villages; and the circular holds the headman responsible for carrying out the rules.

12. *Jails.*—The daily average strength of prisoners in Ajmere jail was 429; the average daily sick, 7; and there were 2 deaths; a mortality of under 5 per 1,000.

In the Native States there are 13 jails, with an average population of 2,783, with a death-rate of 46 per 1,000. Nothing need be said about the Ajmere experience, except that it shows a healthy jail and good management. One of the deaths was from dysentery, and the other from heart disease.

In the Native jails the death-rates varied considerably. In one jail, at Jhalrapatan, the death-rate was no less than 104 per 1,000, 32 per 1,000 of which was due to cholera.

Improvements have recently been effected in several jails, and it is to be hoped that epidemics may cease to attack prisoners as progress is made, for it should never be forgotten that preventible deaths in prison are simply deaths added to the sentence of imprisonment.

13. It will be seen that, general as are the statements in this Report, they show that good sanitary work is being done in Rajputana, and the only recommendation we have to make is that, as far as practicable, it should be continued in conformity with the practical principles laid down in our "Suggestions for the Sanitary Improvement of Indian Stations" (1882).

11th July 1883.

No. 12.

MEMORANDUM of the ARMY SANITARY COMMISSION on the ADMINISTRATION REPORT of the COMMISSIONERS of the TOWN of CALCUTTA for 1881.

1. According to the census of 1881 the population of Calcutta, including all parts of it, stood as follows:—

	Area in Acres.	Population, 1881.
Town proper	3,754	401,671
Esplanade	1,283	3,348
Total	5,037	405,019
Population afloat	—	28,200
Suburbs	14,413	251,439
Grand Total	19,450	684,658

The first totals represent the acreage and population of Calcutta proper. The second represent the total population of what may be called the Calcutta groups, and the area on which they are located. Each of these groups, namely, the town, the suburbs, and the floating population presents its own sanitary features, but it is with the first group that the present report chiefly deals.

Calcutta proper and the esplanade yielded the following numbers, according to sex, at the census of 1876, as compared with the numbers in 1881:—

	1876.	1881.
Males	264,863	260,780
Females	146,976	144,239
Total	411,839	405,019

These results taken by themselves would apparently lead to the conclusion that the population had declined by 6,820 since 1876, but we must bear in mind that the census numbers on each occasion merely represented the closest attainable approximations to the truth at the time, while they necessarily left out the element of movement in the population constantly going on and influenced by the conditions of labour, as well as by actual tendency to change of residence into other parts of the district. A large city, with a large surrounding population, presents elements of error in vital statistics in any case where the registration is limited within a defined area, and the population is liable to movement. But, admitting this much, the census figures of 1881 show an actual decrease in the population of city, suburbs, and floating groups of 2,026; but if the floating population be left out the decrease in 1881 will amount to 12,530.

The apparent disproportion between males and females in Calcutta is explained in the present Report by the circumstance that while on the census night 165,296 married males were enumerated, there were classed with them only 59,382 married females, showing that a large proportion of married men actually lived beyond registration limits. The numbers of unmarried men and widowers amounted together to 95,484, and of unmarried women and widows to 84,857. The facts have an important bearing on the death-rates, because they show that men whose illnesses may be due to Calcutta may die out of it.

Population, according to race, was as follows:—

Christians	22,755
Hindoos	278,762
Mahomedans	124,430
Other classes	7,272
Total	433,219

These numbers include the floating population as well as the city and esplanade. Of this total population 369,162 were born in Bengal proper, and only 7,676 were not Asiatics. The total occupied houses on the census night were 34,534. Houses occupied only by day were 1,409; unoccupied were 2,600.

There were 77,513 families, averaging over five persons each. There were above 11 persons to each inhabited house, and the number of houses per acre was 10. The percentage of males able to read was 35·8, and of females 9·1.

These facts regarding the census population will be sufficient for the purposes of comparison, but they also show that any vital statistics founded on them should be accepted merely as approximations, and it is not easy to see how they can be rendered more reliable until the whole population which really belongs to the capital of India is included, not only in census returns, but in the registration and in deductions from it.

For the present all the data and ratios deduced from them refer to the town population only, which amounted on the census night to 401,671.

2. From among this population there were registered in 1881 the births of—

Males	3,904
Females	3,546
Total	7,450

exclusive of eight births in Fort William.

The birth-rate was 17·2 per 1,000, much too low a rate, but possibly births due to Calcutta, like deaths, may have taken place outside census limits.

3. In 1881 the following deaths were registered—

Males	7,709
Females	5,321
Total	13,030

equal to a death-rate of 30 per 1,000 against a previous 10 years' average rate of 28·7 per 1,000. Calcutta has now for a number of years been supplied with drainage works and water, but still in a very incomplete condition as to details, and we may now compare the rates in years past to see exactly where we have arrived at in the matter of disease prevention. The following have been the death-rates since 1871 :—

Years.	Death Ratio per 1,000.	Years.	Death Ratio per 1,000.
1871	23·7	1877	31·6
1872	23·8	1878	37·8
1873	23·8	1879	30·1
1874	25·6	1880	26·9
1875	32·5	1881	30·0
1876	29·9		

Some allowance must be made in dealing with these figures for two circumstances, namely, that the three earlier years are manifestly incorrect in their death-rates. Either there were too few deaths registered, or deaths due to Calcutta took place out of the registration area, and the year 1878 was a year of scarcity of food, which, no doubt, raised the death-rate of that year, but an answer is required to this question, Why have the rates of the three last years in the table not continued to fall? As we shall presently see, the drainage works have been making progress, and most of the scheme has been completed; but the water-supply has not been adequate to the wants of the people. It is, however, being improved, yet it appears as if some other cause or causes had become of increased importance, and we must see whether any clue to these can be found in the year's disease history, which we shall now discuss.

The following were the deaths registered in 1881 under the usual headings:—

Diseases.	Total Deaths.
Cholera	1,693
Small-pox	133
Fever	3,765
Bowel complaints (diarrhœa and dysentery)	1,491
Other causes	5,948
All causes	13,030

We shall deal with each of these registration headings separately, beginning with—

Cholera.—The cholera history of 1881 presents some points of practical importance which appear to require notice, but before entering on these we may introduce the following abstract, showing the relation of this disease to rainfall, humidity, and temperature.

Months.	Mean Temperature.	Temperature Range.	Humidity.	Rainfall, Inches.	Cholera Deaths.
January	68·4	22·4	66	—	63
February	71·9	28·0	67	—	72
March	76·4	19·7	72	3·45	227
April	85·3	19·8	73	1·97	370
May	84·1	15·2	76	7·40	138
June	83·3	9·8	86	15·12	36
July	83·0	8·5	87	13·42	49
August	83·5	8·7	89	19·61	52
September	82·9	10·0	87	6·75	80
October	79·7	13·4	82	1·50	190
November	71·9	19·2	70	—	232
December	60·9	22·9	71	0·36	267

This table shows that cholera mortality was lessened by increase of rain, and rose with diminution of rain; that the highest death-rates took place in months with highest temperature ranges; that

high mean temperatures and high rates of humidity were not attended by higher cholera death-rates. Moreover, it is shown by past data, that the elements of 1881 did not differ from those of preceding years to any material extent.

5. The Officer of Health's report enables us to show the annual deaths from each of these death causes since 1871, and as the population has not materially changed of late years, the figures which give the total deaths may be safely assumed as showing the extent of annual liability to death from each cause.

The following have been the annual deaths from cholera within the same periods, for which we have given the total deaths:—

Years.	Cholera Deaths.	Years.	Cholera Deaths.
1871	796	1877	1,418
1872	1,102	1878	1,338
1873	1,195	1879	1,186
1874	1,245	1880	805
1875	1,674	1881	1,693
1876	1,851		

During all these years main drainage and improved water-supply have been making progress in Calcutta, and it appears to be necessary to ask the question, not only in the interest of sanitary principles, but of municipal application of these principles, how it happens that such a series of figures as this abstract shows could possibly have presented itself? The data include the years during which works of drainage, water-supply, and conservancy, such as it has been, may have influenced the sanitary condition of the population, and the present inquiry relates only to this period, which, unsatisfactory as its results as regards cholera have been, still contrasts favourably with the normal condition of matters before real sanitary work was in progress. This is shown as follows:—

Years preceding effects of Sanitary Work.	Deaths from Cholera.
1865	5,078
1866	6,826
1867	2,270
1868	4,186
1869	3,582
1870	1,558

Some work was done during the years in this series also, but the average results must be looked for in years subsequent to 1870, given in the preceding abstract, which shows a tendency to increase of cholera mortality, so that while the mean cholera death-rate during 10 years of sanitary work has been represented by 1,252 deaths, the number in 1881 had risen to 1,693. There must be a reason for this result, and it may be safely said that some one is responsible for it.

6. The actual cholera death-rate for the city was 3·9 per 1,000 in 1881, but it differed greatly in different sections of Calcutta. In Park Street section it was 0·8 per 1,000, the lowest ratio. The highest, 5·5 and 6·6 per 1,000, were registered in Burtollah and Coomertooly sections. The death-rate in Hastings section was 4·8 per 1,000.

As cholera is an epidemic disease, the aggravating causes of which are mainly local, these facts apparently point to the presence of unremoved local causes. This view is, moreover, sustained by facts of another kind. For example, the suburban population living outside the limits of municipal sanitary works yielded a cholera death-rate in 1881, not of 3·9 per 1,000, like the rate of municipal Calcutta, but of 7·4 per 1,000. This is not an accidental rate, but is approximately of annual occurrence. Again, the Officer of Health calls attention to the acknowledged greater liability to cholera of non-Asiatics living in India, and that nevertheless these have a lower cholera death-rate in Calcutta than natives, and he attributes this comparative exemption to the better sanitary condition under which Europeans live.

We have next the remarkable facts respecting the law of cholera distribution in 1881, "that "cholera was distributed sporadically throughout those parts of the town habitually prone to it, and "that no localization or spread of an epidemic kind became manifest." And this brings us to the discussion of the local causes of the sporadic cholera of 1881. "The same tendency," we are told, "to grouping around foul tanks and filthy wells was observed as in former years." This was the rule, but there was no apparent aggravation of these customary causes, except in one instance, where carelessness led to an outbreak. The facts are stated as follow. They relate to a collection of huts called Seth Bazan, which presented the usual sanitary defects of foul tanks and general uncleanliness in houses, drains, &c. Cholera had broken out, and 27 deaths had occurred in the vicinity.

"On the 26th March some sweepings were, through a mistake of the Conservancy Department, "thrown into the more southerly of the two tanks, which had not been previously de-watered. The "villagers went on using the water for bathing, washing dishes, &c." Up to 2nd April three cases and two deaths took place near the tank. "On the 5th April a quantity of putrid dall, which "had been condemned by me, was, through a mistake of the Conservancy Department, thrown into "the tank. The material exhaled a foul stench, but the people still went on using the water." The result was the occurrence of eight cases of cholera, out of which seven proved fatal, and two fatal

cases took place near a foul drain. The Officer of Health adds to this lamentable detail that "the "tank has now been filled up, the drains piped, and the village generally improved, and since the "events described no report of unusual sickness or mortality has reached me."

The practical result of the whole cholera history in Calcutta is thus stated by the Officer of Health:—"I am convinced that in the general sanitary improvement of the town, the increased supply "of pure water, the obliteration of foul tanks, hollows, and surface drains, the completion of the "underground sewer system, better means and more efficient carrying out of conservancy, general and "special, and improvement of bustees, resides the hope of reducing the incidence of cholera in "Calcutta." He adds, that "the disease prevailed mainly in the dirtiest portions of the town; and "amongst the poorer classes of dirtiest habits," and that "about 90 per cent. of cholera deaths occur "among the lowest classes of the community, the inhabitants of the bustees."

7. With these official facts before us, the question naturally suggests itself whether they do not involve a grave charge of neglect of duty on the part of the Municipal Commissioners or their executive officers. We have less reserve in asking the question, because our Memoranda have shown year after year that we have had every disposition to acknowledge the large amount of really good work which has been done, and yet we have this startling fact to deal with, that cholera, which is a disease mainly related as to its predisposing causes to filth in air, earth, and water, shows a tendency to increase in amount, notwithstanding the extension of drainage and water-supply.

This question will be reverted to after we have dealt with the remainder of the disease history of 1881.

8. *Small-pox.*—The monthly mortality from this disease was as follows:—

Months.	Small-pox Deaths.	Months.	Small-pox Deaths.
January	5	July	1
February	23	August	—
March	42	September	—
April	40	October	1
May	11	November	—
June	10	December	—

The total small-pox deaths in the year amounted to 133. The births of the year were 7,450, and the vaccinations and revaccinations were 6,538, of which 5,511 were successful. The successful primary vaccinations amounted to 5,416, or five sevenths of the births. Of the vaccinations 2,181 were of infants under one year of age, and 2,380 vaccinated were above one and under six years of age.

9. *Fevers.*—The annual deaths from diseases classed as fevers for 11 years, have been as follows:—

Years.	Annual Fever Deaths.	Years.	Annual Fever Deaths.
1871	4,242	1877	5,151
1872	4,895	1878	6,086
1873	4,632	1879	4,796
1874	4,461	1880	3,797
1875	5,328	1881	3,765
1876	4,361		

As the population of Calcutta has not differed materially in late years, these figures may be taken as representing the annual fever liability since 1871. The year 1878, with its highest mortality in the series, shows the effect of scarcity of food in that year. The fever death-rate has been subject to fluctuations, but during the last two years it has notably diminished, while, as we have already seen, the cholera death-rate of 1881 had very decidedly risen. We have already shown that there has been no important change in the meteorology of 1881 from the average, and it appears to follow that some local conditions favourable to the existence of fever have become lessened, while those favourable to cholera have been increased.

10. The following abstract gives the monthly incidence of fever mortality in Calcutta during 1881:—

Months.	Fever Deaths.	Months.	Fever Deaths.
January	397	July	260
February	324	August	274
March	314	September	275
April	317	October	343
May	244	November	400
June	188	December	429

By comparing these numbers with the meteorological data already given, it will be seen that the highest fever mortality took place in the months of lowest temperatures, with highest temperature

ranges, and after cessation of rain when evaporation was added to these temperature elements; but, as already stated, these variations are only in the monthly data in a given year, while in the years of a series the data have not varied so as to increase or diminish with the fever deaths during the series.

11. The fever death-rate of 1881 was by no means equally distributed over the town. The lowest rates were 3·5 per 1,000 in Waterloo section, and 4·6 per 1,000 in Park Street section. The following sections yielded rates above 10 per 1,000 :—

	Per 1,000.
Toltoolah - - - - - -	10·4
Bamun bustee - - - - -	11·2
Coolootolah - - - - -	11·3
Burra bazar - - - - -	11·5
Collinga - - - - - -	11·7
Hastings - - - - - -	20·1

There are questions raised by these figures which could only be dealt with on the spot; but the death-rate of Hastings is so very high that there must apparently be some tangible reason for it.

Uniform experience has proved that in India, as elsewhere, high death-rates from malarial fever are connected with stagnant subsoil water, but generally in Indian towns there are foul tanks yielding not only malaria, but bad drinking water, and disease causes of this class must not be overlooked in discussing the relation between fever and drainage defects.

12. Besides, the exact nature of these fatal fevers is imperfectly known. Not many years ago they would have been all classed as intermittent or remittent, and afterwards a large proportion were entered under the head of enteric fever, which at the time was supposed to be connected with the new drainage system. There was at the same time a general disposition in certain quarters to connect this fever with house drainage elsewhere than in India, but it happens as a fact, that the enteric fever death-rate in India is furnished by places where there are no drains. There is no doubt, however, that fatal enteric fever takes place in Calcutta, but by no means to the extent that has been supposed. Of deaths so registered, 515 were found by the Sanitary Commissioner to have occurred in children under five years of age, and only 54 for all the remaining ages. During the last eight years, there were 14 post-mortem examinations made at the Medical College hospital of Europeans and Eurasians who had died of fever, of which only two presented the lesions of typhoid fever.

During the same years, 108 examinations of fatal fever cases among natives were made, of which only five showed typhoid characters. With these facts before us, we must apparently conclude that the mortality from fever in Calcutta is mainly due to malarial fevers, aggravated in all probability by local and household sanitary defects.

13. *Bowel Complaints.*—These are classed in the Calcutta Report under the designations of diarrhœa and dysentery, and have yielded the following deaths during the same 11 years period already used for cholera and fever :—

Years.	Bowel Complaint Deaths.	Years.	Bowel Complaint Deaths.
1871 - - -	1,488	1877 - - -	1,488
1872 - - -	1,365	1878 - - -	2,010
1873 - - -	1,551	1879 - - -	1,516
1874 - - -	1,358	1880 - - -	1,267
1875 - - -	1,579	1881 - - -	1,491
1876 - - -	1,864		

The year of highest bowel complaint death-rate, 1878, was the scarcity year, and 1881 has a corresponding increased rate from these diseases to that shown in regard to cholera in the preceding table, and to complete the parallel we shall abstract the monthly deaths under this head as follows:—

Months.	Bowel Complaint Deaths.	Months.	Bowel Complaint Deaths.
January - - -	190	July - - -	95
February - - -	124	August - - -	96
March - - -	123	September - - -	92
April - - -	107	October - - -	108
May - - -	102	November - - -	153
June - - -	67	December - - -	324

By comparing this table with the preceding one showing the relation of cholera mortality to meteorology, it will be seen that the elements which increase bowel complaint mortality are the same as those which influence the cholera death-rate, namely, falling temperature and increased temperature range. But neither of these climatic conditions could of themselves give rise to the increasing

epidemic death-rates, which we are sorry to see have passed over to the year 1882 following the present report, for the Officer of Health's more recent returns show a rise in the total death-rate of Calcutta to 30·5 per 1,000, while the total cholera deaths, which in 1881 amounted to 1,698 had risen in 1882 to 2,240, and the fever deaths, which numbered 3,765 in 1881, were 3,610 in 1882, no great reduction, but showing apparently that there has been some constant cause of reduction in fever mortality in operation, for the fever deaths of 1882 were lower in number than those of any previous year, while the cholera death-rate was the highest which has presented itself since 1870 We shall next abstract a brief statement to show what is the present condition of sanitary work in the city, and whether this affords any satisfactory explanation of the facts.

14. *Drainage.*—The original drainage scheme included 10·78 miles of first-class sewers, and 23 miles of second-class sewers. Both were completed by the end of 1880. But besides these there were 154 miles of third-class pipe sewers, of which, all but 21·12 miles were completed by the end of 1881, leaving this length to be laid in subsequent years. The great work of sewering and draining Calcutta and freeing its subsoil from water was thus nearly finished.

The number of premises connected with these sewers is 16,400, or nearly one-half the premises of Calcutta. The amount of sewage per diem pumped out of the sewerage system and discharged at the outfall in 1881 averaged 13,471,570 gallons, against the previous year's daily average of 13,529,345 gallons. The difference is not great, but it raises the following point for consideration. The use of the entire drainage system, including its pumping arrangements, is to keep the sewers empty, and to prevent stagnation, back watering, and deposit. Now, if from any mistaken economy, the pumping is reduced, one result and one result only can follow, namely, the accumulation of sewage and deposit under the houses, and of water in the subsoil, and increase of fever. Efficient pumping is as much a part of the sewage system as are the sewers. It appears from the report that want of flushing has already been experienced, and it is just possible that part of this defect may have been due to the cause stated.

The filtered and unfiltered water-supply of 1881 was 8,442,770 gallons per diem, only part of which would enter the sewers. The sewage pumped was hence a third more than the water-supply. The remainder would be due to rainfall entering the sewerage system, or part of it. The total fall according to the Officer of Health was 69·58 inches, which was 3·20 inches above the average.

House connections with the sewers have to be refused on account of want of sufficient water, "and "hence," says the engineer "it must be again recorded that the principal object for which the "sewerage system now rapidly approaching completion was designed remains unfulfilled."

In this incomplete state of water-supply arrangements, the night-soil has to be removed by 1,100 mehters from 37,940 privies, and then follows this important statement:—"The number of privies "in 1878 was 31,460, served by 1,368 mehters, consequently the work has increased 20 per cent., "while the number of mehters has decreased by upwards of 19 per cent." The night-soil from latrines and privies is carried to 27 depôts, where it is run into the sewers with water, and thence to the pumping station at the outfall. Complaints of inefficiency of service have been very few, but it is easy to see how any remissness in this important department of public service may be followed by sickness.

Thus far we have two facts regarding fever mortality, namely, extension of the drainage works and removal of sewage and lowering of subsoil water level, with decline in general fever mortality over the under-drained area.

15. The suburban area is not under-drained, and while the fever death-rate of the whole drained town area averaged 8·6 per 1,000, the fever-rate for the undrained suburban area was 19·6 per 1,000. We have already seen that the fever death-rate varies in different divisions of Calcutta, but in regard to only one of these divisions, Hastings, have we the means of contrasting the fever death-rate with the drainage. Hastings is not under-drained, and its fever death-rate in 1881 was 20·1 per 1,000, which it will be seen is a little higher than the rate of the undrained suburban area. The drainage of Hastings has been deferred for want of water. These facts have a very important bearing on the relation of subsoil cleansing and drainage to fever mortality, and they belong to a class of experience which may eventually show the necessity of under-draining all Indian towns. They are in entire consistence with experience obtained in the open country as to the relation between subsoil water level and fever prevalence, and their practical result would, no doubt, be to prove that surface drained towns could not attain to any high condition of health. Even at present, as we have shown shown on other papers, there are surface drained towns which show very high fever and general death-rates.

16. This appears to consitute the reply to the first part of our question why there has been a falling fever-rate, with a rising cholera rate, but before following up the other part of the inquiry, it is necessary to notice the question of enteric fever in connection with Calcutta sewerage.

A number of years ago an outcry was raised in England against house cleansing by sewers because, in some cases, there had been enteric fever in drained houses. This opinion was carried to Calcutta just at the commencement of the drainage works there; and, in consequence apparently of English opinion on the subject, the proposed drainage scheme for Calcutta was unsparingly condemned. This opinion, however, gave way before experience, and we now know, as already stated, that the great majority of typhoid fever cases among Europeans in India take place where there are no sewers or drains, and that the etiology of enteric fever is by no means so simple a problem as the sewer theory takes for granted.

The record of enteric fever in Calcutta appears to have alternated in amount with the record of remittent fever. True enteric fever is a rare disease apparently in Calcutta, but cases have happened where blame has been laid on the sewers. Sewers themselves, unless in a ruinous condition, or unless they are so constructed as to become sewers of deposit, cannot occasion enteric fever, but there are matters of detail which, if neglected, might, under certain conditions, occasion enteric fever attacks. We have already alluded to defective pumping at the outfall as one of these. Again, all sewer systems require flushing, a means of cleansing as yet imperfectly adopted in Calcutta. All sewers, again, require ventilation, and most important perhaps of all, there ought to be no direct connection between any house drain and any sewer. The required precautions are not difficult of execution, and are described in our revised "Suggestions" of 1882. They are simply part of the drainage arrangements of the city, and if they are left out of calculation no one has any right to complain if enteric fever cases occur occasionally.

17. *Conservancy.*—From what has been said regarding experience already obtained as to local fever causes, it may be safely assumed that the fundamental cause requiring to be dealt with is foul subsoil and stagnant subsoil water, and that the real remedy for high fever death-rates lies in extending the works of drainage until both city and suburbs are subsoil drained throughout, and foul tanks abolished. But while insisting on this fact, we cannot forget that fever types and fever mortality are both aggravated by local filth causes, and that these causes also increase the fatality of cholera. For practical purposes therefore we must inquire to what degree of efficiency the present conservancy system has attained, what are its defects, and how they are to be remedied, and in this way we may arrive at some explanation of the increase of cholera mortality. The following is the account given by the Engineer of the working of the present system of conservancy. "Refuse is, as a universal rule, "thrown out from the houses and deposited in heaps by the occupiers. . . . . The street litter "having been swept up into heaps and the house refuse thrown out, the carts do their work of "collecting the sweepings and refuse, and convey them either to tanks that may be in the course of "filling, or to the platforms (of which there are six) of the municipal railway, where they are tipped "into waggons and hauled away to the Salt-Water Lakes for final disposal. . . . . The work "in the town streets is usually completed by 11 a.m. or noon."

This is all plain enough, but in practice the following difficulties were met with:—"At the "commencement of the year great difficulty was experienced owing to the inability of the "gowkhanahs to supply carts and cattle up to the budget provision, and in consequence box carts had "to be hired to do the work. The full budget number was available during the second quarter, "but it has to be admitted that they were inadequate. The want of carts and cattle becomes an "agravated sore, and causes distress of a most threatening nature on the occurrence of rain, and "more or less throughout the rainy season, when the sweepings and refuse become heavy with wet, "and the general dirt to be removed becomes greater in quantity, men and cattle become over-"worked, the operation of cleansing becomes delayed to a late hour of the day, and many back "streets and lanes are left to take their chance with festering heaps of muck and garbage. Of course, "as much as possible is done by hiring carts, but there is a limit to this, as the demand for carts "throughout the town is very great and is increasing."

"Then the want of wagons at the railway platform has oftentimes aggravated the evil to an intense degree; the loaded carts have had to be taken into the gowkhanahs and emptied at the platforms in the early morning into waggons which have been brought to the platforms overnight, thus entrenching on the time that they should have devoted to collecting the dirt of the town. On several occasions there were great apprehensions of utter collapse."

These facts stated by the engineer of the municipality, apart from the condition of tanks and bustees, would be sufficient to explain the late increase of cholera mortality, and we are glad to see that their importance is insisted on by the Chairman of the Commissioners in his report. "A "sufficient establishment of conservancy carts," he says, "is also a *sine quâ non* to remove the "annually increasing heaps of refuse which are being brought within their reach. Above all, effectual "and intelligent supervision over the nuisance and night-soil departments, and the systematic "enforcement of the conservancy sections of the law, is indispensably requisite. These questions "are under the consideration of the special conservancy committee now sitting." Of course, we have no information as to the intended improvements in the cleansing service, but it is clear that, up to the date of the report, the public health in the capital of India was subject to a danger, which was long thought to be a matter of the past, namely, cholera epidemics, to a great extent due to insufficiency in cleansing, and want of a rigid organisation in the cleansing department. The rainy season and its requirements, and not the dry season, ought to be adopted in future as the measure o plant and of work required for city conservancy. The Officer of Health has told us that cholera increase has been of a sporadic kind, but, under the conditions described by the engineer, the disease may at any time become epidemic, and make its appearance in quarters where it is least expected.

18. This want of thorough general cleanliness and keeping clean is, however, only one of the causes of these sporadic cholera outbreaks, but it is, perhaps, the cause of most importance, because it admits of immediate removal. Others, requiring more time for eradicating them, are the foul tanks and bustees, to which we have often referred in previous memoranda.

Bustee improvement has been commenced by inspection and registration of them. The number of these disease centres on the register at the date of this report was 486, and of these 48 had been surveyed and plans of improvement made, but, unfortunately, the existing legal powers do not make

the committee sanguine of being able to effect "any very substantial improvement" in their sanitary condition. "At every step the bustee committee finds its projected improvements hampered by the "legitimate objections of proprietors, so that such works as can be eventually insisted upon fall very "far short of the ideal project as first planned;" and there follows this account of the present state of matters:—"The refuse which now remains in bustees unremoved, and which the opening up of roads "will enable the Commissioners to remove, is not by any means the greatest sanitary defect. The "foul and filthy drains which intersect the bustees, full of festering sewage and manure, is a far "greater evil; and, while little can be done to remove this under the bustee sections, there are other "sections under which the corporation have power to remove these evils, though not without some "expense. The filling up of tanks, a very important measure, can be done without resorting to "bustee procedure."

It will be seen that the practical result of this state of the case is simply as follows, that a considerable area of Calcutta, upwards of 3,054 beegahs, inhabited by a large crowded population, does not admit of being properly cleansed, apart altogether from tank filling and draining.

The question may be asked, whether this dangerous evil is to be allowed to continue, or whether the owners ought not to be compelled to keep their properties clean. Surely they can be required to collect and deposit in some convenient place all the bustee filth, to be then removed by the municipal officials, until proper road improvements may enable the municipal authorities to undertake the work, and to cleanse and keep clean all drains.

Opening up of bustees appears to be a slow process, for in the first case taken in hand the final orders were not issued until 13 months after the first inspection, and it was calculated that six or seven months would elapse before the works were completed. Yet all this time the more immediate disease cause to be dealt with, namely, the filth and cholera consequent on its presence, is to be left for indefinite periods.

19. We have so frequently described the sanitary, or rather the insanitary, results of Calcutta tanks, that it is unnecessary to revert to this potent disease element. In 1879, when a survey of the tanks was first made, there were 534 of them. Since that time 34 tanks have been taken in hand, leaving 500 untouched.

The Commissioners appear to consider that if in the next five or six years 100 of these can be filled up it will be good work. No doubt time must elapse before such an immense surface as these tanks present can be covered, but on the score of public health and economy it may be safely said that no outlay that can be incurred to abolish them forthwith ought to be complained of. We formerly gave a caution against using any putrescible refuse for filling, and this caution, as we have already seen, has been furthe enforced by cholera experience in 1881.

20. From what has been said it will be seen that increase of cholera in Calcutta is a perfectly legitimate consequence of filth unremoved and accumulating among the dwellings of the people, and we have also seen where the blame of this lies. But these remarks are not intended to detract from the credit justly due to the local authorities of the city for the works of drainage and water-supply they have carried out, which, however, in no sense lessen the obligation resting on them to persistently cleanse and keep clean every corner of the city.

21. *Water-supply.*—The following is a brief digest of information contained in the report on this important subject.

There are six settling tanks at Pultah, each 500 feet long by 250 feet broad and 7 feet deep, into which water from the river is raised by steam power. Thence it is filtered by 12 filters, each 200 feet long by 100 feet broad. The filtered water flows by gravitation through a 42-inch main to Tallah, where there is engine power by means of which it is forced into the town mains, to Wellington Square pumping station, where it is raised by steam power for distribution. The total number of premises connected with the water mains in 1881 was 15,386, out of a census total of 34,534 houses.

The average daily consumption of water in 1881 was 7,208,453 gallons.

The house connexions are made by 26 licensed firms of plumbers, and every connexion is personally supervised by the municipal inspector. In the course of the year water inspections were made, 26,190 in number, to discover the condition of fittings, and 3,189 leakages were found and repaired. Additional hydrants were put up. But as we showed last year, hydrant water should be supplied to the bustees, where water at present is little better than sewage. An analysis of hydrant water shows that, taken over all, the quality was of the usual annual average, but in certain details the results showed defective filtration on certain days, which the engineer accounts for by an excessive amount of suspended matter in the river water, and difficulties in the way of filtration. There appear to have been local defects also in the depositing tanks and filters. These, no doubt, will be remedied, but we have referred to them in order to suggest that it is just as necessary for protection of the public health to see to the constant efficiency of all sanitary works as to see to their original execution.

This matter is forcibly dwelt upon by the chairman of the Commissioners in his own report, who states that the filtered water is more and more in demand, so that the present amount of water is "very insufficient, and is daily becoming more so."

This result was foreseen by the Army Sanitary Commission, who gave a caution on the subject before the works were commenced, which had it been followed would have saved much outlay in extending the supply.

22. *Barrackpore water-supply.*—This supply comes originally from the Calcutta source, and is provided as follows:—

"(1.) One filter, 72 feet by 50, capable of delivering 180,000 gallons in 24 hours.
"(2.) Two compound direct-acting pumping engines capable of delivering 10,000 gallons per hour "to a height of 70 feet.
"(3.) One elevated reservoir in the cantonments of Barrackpore 35 feet 6 inches high, capable of "holding 120,000 gallons.
"(4.) Seven miles of mains and service pipes from 9 inches to two inches diameter, and 19 stand-"posts.
"(5.) And lastly, service pipes and fittings for the supply of all the Native Infantry lines and "European barracks, with all their several bath-rooms and cook-houses."

The actual cost of the works was 10,044*l.*

The daily average water-supply has been 35,961 gallons since the works were completed.

It is to be hoped that since the Barrackpore problem has been at last solved at so moderate an outlay, this example will be followed at many similarly situated stations.

23. *Unfiltered water-supply.*—This water is pumped direct from the river, and is laid on by separate service to hydrants for street purposes, and for latrines, night-soil depôts, &c. The amount of water used for these purposes in 1881 was 1,257,300 gallons per diem, and was of course so much saved of the filtered supply.

24. There are a few other points in the Report under review which might have been noticed, but they occupy quite a subsidiary place when compared with that which is the real problem to be dealt with by the Calcutta municipality, namely, the great increase of liability to epidemic outbreaks notwithstanding the execution of works of drainage and water-supply. Sanitary improvement would be an easy enough matter if it depended solely on the carrying out of engineering works, and then leaving them to themselves. But engineering works are only a means to an end, and whether they finally succeed, or finally fail, depends entirely on the degree of care bestowed on their working. Again, it is by no means sufficient to organize in any way nearest at hand, the conservancy department of a great city, which of all parts of sanitary work is the one most immediately necessary for protecting the public health. With a system so disjointed as the conservancy department described in this Report, increase of cholera follows as a matter of course.

The experience is no doubt valuable, but the people who have suffered are not those who were charged with its execution, towards which many of them no doubt paid rates.

The practical teaching is that the whole sanitary work must be much better done, and that of all sources of economy which a municipality can deal with, the very last, and in the end the most costly to the entire community, is not providing for the efficient discharge of sanitary duties. We do not know to what extent economizing may have been adopted in the present case. We can only judge by the results given in the Municipal Report of the year, and of the unsatisfactory nature of these there can scarcely be two opinions.

12th June 1883.

No. 13.

Memorandum of the Army Sanitary Commission on the Administration Report of the Madras Municipality for 1881.

1. The present year's Report is mostly devoted to municipal administration details and statistics not calling for remark, and there is very little in it bearing on questions of public health or on the prevention of disease. Our estimate of the general sanitary state of the city must, therefore, be based on the experience of past years, and we shall take from the Report for 1881 such facts as may continue the history to the end of that year.

2. The house population of Madras at the time of the census of 1881, when compared with the same class of population at the previous census, yields the following comparisons:—

Years.	Males.	Females.	Total.
1871	191,924	201,996	393,920
1881	193,635	204,277	397,912
Increase in 1881	1,711	2,281	3,992

The house population of 1881 was lodged in 47,405 occupied houses, or at the rate of 8·4 inhabitants per occupied house, but there were 15,988 unoccupied houses, or above 25 per cent. of the total house accommodation.

Besides the house population of 1881, there were the following groups which went to make up the total inhabitants :—

	Males.	Females.	Total.
Fort St. George	830	331	1,161
Houseless poor and travellers	4,294	1,299	5,593
Marine population	1,028	40	1,068
Canal and travelling	311	4	315
Railway and travelling	116	42	158
Total	6,489	1,716	8,205

The actual census population was therefore :—

Males	200,124
Females	205,993
Total	406,117

Omitting the marine and travelling population, which were not included in the census of 1871, the remainder of all classes was as follows :—

	Population.
1871	399,140
1881	404,636
Increase in 10 years	5,496

But of this increase 1,871 was due to houseless and travelling poor, so that to all intents the population of Madras is stationary, but, if judged by the number of uninhabited houses the population has actually been decreasing or becoming poorer, with less means of paying for house room.

3. The registered births in 1881 were, of—

Males	7,841
Females	7,635
Total	15,476

or 38·9 per 1,000 of population. Besides these living births, there were 549 still-born in the course of the year.

4. Registered deaths in 1881 were, of—

Males	7,784
Females	7,703
Total	15,487

The calculated death-rate was the same as the birth-rate, namely, 38·9 per 1,000, the mark of a decaying population.

5. The following abstract gives the death-rates calculated on the resident population since 1870 :—

Years.	Death Ratios per 1,000.	Years.	Death Ratios per 1,000.
1870	29·9	1876	39·6
1871	32·7	1877	98·2
1872	35·2	1878	47·5
1873	36·7	1879	34·7
1874	36·8	1880	37·4
1875	35·5	1881	38·9

During the earlier years of this series, the registration appears to have been less complete than in recent years. In 1876 the first foreshadowing of the famine mortality began to appear. In 1877 came the famine, and the almost 10 per cent. death-rate of the year includes the deaths from starvation and famine diseases amongst a great influx of poor starving people from the country, whose deaths appear to have been calculated on the resident population. In 1878 the calamity had not entirely passed away, but it is probable that the two last years in the series show approximately the normal death-rate of Madras in non-epidemic years.

6. The city of Madras includes 36 population groups or villages, in which the death-rates ranged considerably above as well as below the total average.

The lowest death-rate of the year was 2·5 per 1,000 in Fort St. George. In four villages the rates were under 20 per 1,000. In three they were between 20 and 25 per 1,000. In seven the rates lay between 30 and 40 per 1,000. But all the others had rates exceeding 4 per cent. The highest rates were 40·7, 46·4, 58·4, 64·3, and 65·1 per 1,000. The facts show that disease and death causes are grouped in special localities, in which the work of the sanitary improver is most required.

7. Unfortunately, the present report contains no information of the local causes on which these great death-rates depend.

8 The next abstract gives the total deaths from each principal cause in 1881:—

Diseases.	Total Deaths.	Ratios per 1,000 of Population.
Small-pox	1,654	4·1
Measles	299	0·7
Fevers	3,698	9·3
Dysentery	1,225	3·0
Diarrhœa	700	1·7
Cholera	126	0·3
Injuries	64	0·2
Other diseases	7,731	19·4
Total	15,497	38·9

It will be seen that the least important disease of the year was cholera. But in Madras cholera is liable to great variations in intensity, as will be seen from the following annual deaths from this epidemic disease:—

Years.	Cholera Deaths.	Years.	Cholera Deaths.
1870	861	1876	2,105
1871	493	1877	2,025
1872	5	1878	85
1873	6	1879	35
1874	—	1880	2
1875	935	1881	126

Madras appears to be liable to sudden and severe outbursts of cholera. The high death-rate in 1877, the famine year, was apparently the culminating point of one such epidemic.

9. In 1881 the deaths from cholera all took place in 12 population groups, and in several of these there were only one, two, or three cases. The disease was strictly endemic. The largest number of deaths, 23, took place in a fishing village, Cashmode, containing a population of 12,383, in November and December. No sanitary account is given of the houses or localities where cholera took place. Only stress is laid on the fact that there were dhobies where there was cholera; but we are not informed whether there were dhobies where there was none. It is simply an erroneous way of recording coincidences.

10. The most satisfactory part of the year's cholera history was, that additional sanitary precautions, especially in the way of conservancy and warning against the use of bad water, were taken, and that the people were warned to be careful when diarrhœa cases occurred.

As a general rule it may now be considered as established by experience that the best temporary safeguards against cholera, when epidemics are in the air, is perfect cleanliness of houses, persons, and their surroundings, and the use of pure drinking and culinary water.

11. *Fevers.*—It will be seen from the following abstract that if the registration were entirely reliable, fever mortality is on the increase since the famine year 1877:—

Years.	Fever Deaths.	Years.	Fever Deaths.
1870	2,296	1876	2,351
1871	2,474	1877	6,407
1872	2,848	1878	4,982
1873	2,569	1879	3,465
1874	2,879	1880	3,549
1875	2,445	1881	3,698

Fever is a famine disease, as is distinctly shown by the high death-rates in 1877–78, but experience in subsequent years must be taken as showing increase of local fever causes, or increased susceptibility in the population. All the population groups, except four, yielded fever deaths in 1881, but the disease was far more prevalent in some villages than in others.

The great remedy for fevers is drainage, cleanliness, and ventilation, and fevers will generally be found to prevail where these measures are not attended to. In a sea-side town like Madras there ought to be little indigenous malarial fever.

12. The next abstract shows the monthly prevalence of fever in 1881 :—

Months.	Fever Deaths.	Months.	Fever Deaths.
January	406	July	308
February	340	August	261
March	308	September	311
April	276	October	334
May	301	November	257
June	270	December	329

It would appear from these figures that in 1881 the fever mortality was little influenced by climatic causes, and that the local causes had remained tolerably constant throughout the year.

13. *Small-pox.*—As already stated, there were 1,654 deaths from small-pox. The disease appeared in all the population groups, with few exceptions, but the amount of it varied greatly in different groups. Several escaped with three or four deaths; but in one village, Peddoo Naick's Pettah, there were 451 deaths among 65,629 people, or nearly 7 per 1,000.

The vaccination staff of the year consisted of the following officers :—

First-class Deputy Inspector	1
First-class vaccinators	4
Second-class vaccinators, males	10
Second-class vaccinators, females	10
Probationer	1
Peon	1

The year's vaccination work stood as follows :—

Births	15,476
Successful vaccinations under one year	8,456
Successful vaccinations from one and under six years	8,746
Successful vaccinations from six years and above	10,441

The total work at all ages during 1881 was,—

Total vaccinations	30,908
Of these successful	27,643
Unsuccessful	1,960
Unknown	1,305

About a tenth part of the population of Madras town was vaccinated in 1881.

14. The following abstract gives the monthly prevalence of small-pox :—

Months.	Small-pox Deaths.	Months.	Small-pox Deaths.
January	93	July	106
February	175	August	101
March	405	September	56
April	314	October	29
May	179	November	24
June	142	December	29

These figures show the presence of small-pox in an epidemic form.

There appears to be nothing further in the year's disease history calling for remark. The chief lesson which it conveys is that high death-rates in Madras are local, and that their causes must also be local and dealt with as such.

15. *Sanitary measures.*—In the present condition of the municipal finances, and until the question has been decided as to who is to pay for the necessary sanitary works, we would strongly advise that the chief reliance for warding off attacks of epidemics should be placed on conservancy. Much has already been done in this direction, but it is scarcely satisfactory to be told that "the permanent conservancy staff is very insufficient," and that it had to be added to when cholera was in town, and "very considerably in certain villages where cholera had been most fatal." This proceeding is wrong in principle. In a town of 400,000 people, without any provision for domestic drainage and water-supply, every part should be kept in a constant state of cleanliness. The worst of all times for cleansing is the time when cholera prevails, because any disturbance of filth heaps at such times is dangerous to the public health, and may lead to increase of cholera. We are told in this Report

that in the attacked villages "the latrine accommodation was extremely scanty, and what latrines "there were were in exceedingly close proximity to the wells from which their water was drawn." Some slight additions have been made to the latrine accommodation recently, and additional dust-bins have been provided, but the people in most localities have still to depend for water on wells dug in fouled subsoils, and a large staff of men, animals, and carts are employed to do the work, which, under a proper sanitary system, would be done by gravitation.

In 1881 the cost of all branches of conservancy was 21,980*l.* This includes the pay of 1,079 coolies, and the maintenance of 532 carts and four canal barges. The actual work done included the removal of 253,711 cartloads of rubbish and 20,000 tons of night-soil.

16. *Drainage.*—Nothing appears to have been decided about the general drainage of houses and localities. The black town surface drains were to be executed by a loan of 10,000*l.* as a commencement. The most satisfactory statement in the report under the head of drainage works is the progress made in diverting the foul drains which have hitherto emptied into the Cooum. It was calculated that this work would be completed in another year, and a great nuisance and danger to the public health will in this way come to an end.

The main outlet drain to the sea, another source of nuisance, was also to be improved.

17. Six sewage farms were under cultivation during the year. The expenditure on them was 1,031*l.* and the receipts 897*l.* There must be something amiss in their management; either the sewage is unsuitable, or the farms require too much superintendence on account of limited area, or the crops are not those adapted to this kind of treatment.

18. *Water Supply.*—The quantity of water which flowed from Red Hills lake into the delivery channel was 4,839,592 cubic yards. The amount drawn off represents a consumption of 11¼ gallons per day for 200,000 people, or half the population of Madras. Extension and improvement of the supply were both under consideration, but it would appear that the present amount would afford five gallons per head per diem for the whole population if the pipe service were extended, and in this way the necessity for using well water for drinking and culinary purposes might be avoided.

19. These are the chief practical points included in this report. There are details of work given, which show that much useful improvement was carried out in course of the year.

The great deficiency is, of course, the absence of drainage and water-supply to houses, and the condition of house compounds, to the frightful state of some of which only attention was called by the Sanitary Commissioner of Madras a year or two ago. On the evidence before us, it became our duty to represent very strongly to the Secretary of State for India in Council the flagrant apparent neglects from which such a state of things had arisen, even to the extent of raising a question whether the improvement of this large presidential city ought not to be taken out of the hands of the municipality.

In papers transmitted to the Army Sanitary Commission, with the present year's municipal report, a defence is set up against our attack. We have no desire to make any reply, and, so far as concerns the facts and their results to the public health, we have nothing to retract. The questions relate to facts and not opinions, and we accepted the facts as coming from quite trustworthy authority, while we pressed their inevitable results on the executive authorities. If the Madras municipality can do the work with or without additional powers or facilities, we shall be perfectly satisfied.

We are willing, at the same time, to give due weight to the revelations of the last census as to the condition of the population, but it should not be forgotten that ill health in times past may have played no unimportant part in leading to decay and impoverishment of the population, the last element, be it observed, being the one now pleaded by the municipality as a reason for not expending sufficient capital to enable them to put their great city in a sound sanitary state.

20. Whether, under the circumstances, the Government should lend a helping hand to the authorities to recover lost ground is not for us to say. Any way many years must elapse before the work is done, but, as we have already pointed out, the most needful of all work, namely, complete cleansing and keeping clean by the municipal executive of every street, alley, compound, and open space, and the removal of cattle outside inhabited limits, can be done with the existing municipal income, and this practically is the conclusion at which we must arrive from the data in this and in preceding Reports. But it in no way detracts from the opinions we have expressed as to the urgent need of combined works of drainage and water-supply for every village in the more dense portions of the city.

11th July 1883.

No. 14.

Memorandum of the Army Sanitary Commission on the Report of the Bombay Municipality for 1881.

This Report is chiefly made up of municipal administrative details not coming within the scope of our remarks, and the principal points bearing on the sanitary condition of the city of Bombay are those contained in the report of the officer of health, to which we propose mainly to direct attention.

1. The population of the city at the census of 1872 was 644,405. The next census that of 1881, gave the population at 773,196, an increase in 10 years of 19·98 per cent. This latter enumeration revealed the startling fact that for every 100 females the city contained 150·68 males, although this proportion of males is lower by about 13 per cent. than the ratios of 1872.

The city contains now 128,791 more people than it lodged 10 years ago, and amongst the increase must be noted an influx of 12,775 low caste population, by which the number of this insanitary class has risen to 49,122, involving increased vigilance and expence on the part of the municipality or increase of mortality from epidemics.

2. The following abstract gives the classes of population, together with their numbers, in 1881, and their death-rates in the same year :—

Castes.	Census Numbers.	Deaths per 1,000.
Boodhists and Jains	17,216	55·87
Brahmins	35,428	19·05
Lingets	1,167	37·70
Bhatias	9,417	30·37
Hindoos of other castes	407,717	27·24
Hindoo outcasts	49,122	34·48
Mussulmans	158,624	31·06
Parsees	48,597	20·10
Jews	3,321	24·99
Native Christians	30,708	23·41
Indo-Europeans	1,168	37·67
Europeans	10,451	22·77
Negro Africans	689	129·17
Chinese	169	47·33
Total	773,196	27·65

The death-rate calculated on the annual increment of population was thus 27·65 per 1,000. The registered deaths numbered 21,856.

3. The registered births were 16,688, equal to 21·51 per 1,000, evidently below the truth.

4. The next abstract gives the population in 1881 of each locality, together with the aggregate death-rates.

Localities.	Population, 1881.	Death-rates per 1,000.
Upper Colaba	2,867	40·46
Middle Colaba	14,265	24·18
Lower Colaba		
Fort, Southern	8,515	5·63
Fort, Northern	33,822	22·20
Esplanade	13,080	22·78
Market	49,130	24·43
Mandvee	43,351	32·23
Chuckla	37,048	34·41
Oomercary	54,656	32·56
Dongree	38,290	31·57
Phobee Talao	39,409	30·62
Funuswaree	23,218	24·20
Bhuleshwur	33,106	29·41
Khara Talao	28,691	40·04
Coombarwara	34,990	29·26
Khetwaree	39,486	24·96
Girgaum	25,319	27·64
Chowpatee	10,975	27·15
Walkeshwur	11,308	19·46
Mahmluxmee	6,232	22·30
Mazagon	27,904	21·82
Tarwaree	14,542	18·56
Camateepoora	64,658	36·17
Byculla	36,214	30·40
Parell	13,560	34·42
Seoree	5,553	35·10
Seo	17,237	18·21
Mahim	17,809	26·74
Wurlee	14,621	16·34
Water division	24,887	3·27

We have in this table the fundamental data from which the sanitary condition of every population group in Bombay can be deduced. It will be useful for future reference as from a well ascertained starting point. No doubt the ratios may rise and fall year by year all over the area but at all events, the facts as they stand may be accepted as sufficient for the purpose.

5. The following were the chief death causes for the year ending 31st December 1881:—

Diseases.	Total Deaths.	Deaths per Cent. of Total Deaths.	Deaths per 1,000 of Population.
Small-pox	35	0·2	0·05
Measles	192	0·8	0·25
Enteric fever	11	0·1	
Simple continued fever	400	1·7	8·32
Ague	942	4·1	
Remittent fever	5,084	22·1	
Cholera	545	2·4	0·71
Diarrhœa	1,341	5·8	1·73
Dysentery	731	3·1	0·93
Respiratory diseases	3,799	16·5	4·91
All causes, exclusive of still-born	21,856	100·00	27·65

In this enumeration of death causes the febrile group accounts for 28·0 per cent. of the total mortality of the year. On the other hand, cholera was quite a subordinate death cause.

6. *Cholera* first appeared in March, and yielded deaths afterwards in the following numbers:—

Months.	Deaths from Cholera.	Months.	Deaths from Cholera.
January	—	July	124
February	—	August	78
March	2	September	49
April	9	October	34
May	88	November	9
June	85	December	91

There were no cholera deaths in Upper Colaba, but all the other localities had a few deaths.

In the remaining 30 localities the cholera deaths-rates to population were under one per 1,000 except in five, in four of which the mortality was under two per 1,000, and the other, Funuswaree, with a population of 23,218, yielded 55 cholera deaths, equal to a death-rate of 2·36 per 1,000, the highest of the year.

7. In our memorandum on the Report of the Sanitary Commissioner of Bombay Presidency, we have quoted a table showing the past cholera history of Bombay city, and the great falling off in annual deaths from cholera, even in epidemic seasons, which has accompanied the work of sanitary improvement, particularly in the matter of conservancy. The experience of 1881 confirmed that of past years, and is introduced in the present Report by the following practical statement, which is of infinitely greater importance to public health and national interests than all quarantine requirements and disease theories. The officer of health says, "I would refer first to the great principle on which "measures of precaution should be based; that principle, the teaching of our experience indicates, is "cleanliness, in its widest sense; my experience in this year confirms the conviction and belief of "former years, that the true line of precaution supplementary to personal vitality, wholesomeness "and cleanliness, is cleanliness (soil purity, air purity, food and drink purity) in its widest sense. "The more nearly sanitary precautions approach the standard of cleanliness, the more perfect."

8. We may just remark in passing that this principle laid down by the officer of health, as the result of his personal experience, is applicable to ships as well as to houses, and if it were fully applied in both cases, that is, if European nations would simply keep their seaport towns and houses in a proper state of cleanliness, and subject foul ships to sanitary cleansings in the same way as they ought to see to the cleansing of their ports, there would be no excuse whatever left for the quarantine doctrine, one of the objects of which is the protection of foul seaports at the expense of clean healthy ships, ignoring in this way the real sources of danger to the public health from all epidemics.

9. During the cholera of 1881, in Bombay, the remedies applied were cleansing, removing people out of affected houses, openings made for ventilation, including removal of tiles from roofs. Earthen floors were dug up and sprinkled with carbolic acid, and to such precautionary measures is no doubt due the low cholera mortality of the year.

10. The relation of cholera mortality to localizing causes may be briefly summarised as follows:—

Water sources.—Bombay has now a supply of pure water from the Vehar and Tulsi works, but part of the population is still dependent on wells of doubtful character. If it were of any use to press the evidence of facts as against vague etiological opinions the following data which are merely a repetition of facts observed in Bombay year after year, ought to have weight with those officers who still act on the idea that water is the main agent by which cholera is spread:—

Water Sources of Consumers.	Cholera.		
	Cases.	Deaths.	Per-centage of Deaths to Attacks.
Vehar and Tulsi - - - -	542	421	77·67
Well water - - - -	123	91	73·98
Not known - - - -	38	34	89·47
Total - - -	703	546	—

These facts show that the pure municipal supply did not protect its consumers from cholera, for above 21 per cent. of the cholera deaths took place among them, while the table shows that the disease was more fatal among this class than among well-water drinkers.

The facts by no means show that the quality of water used by a community has no influence on the amount of cholera, for this relation has been quite sufficiently proved. They only show that impure water is not the sole cause of cholera, and further that if it were so any future improvement in cholera death-rates in Bombay would be impossible.

11. There are, however, other causes in operation (besides well-water for example) which would tend to increase predisposition to cholera attacks during epidemic periods. The officer of health has proved statistically that the great majority of deaths from cholera took place on ground floors of houses pointing to the influence of subsoil causes and deficient air movement. We shall return to this element subsequently; and he has also shown the existence of a direct ratio between the amount of cholera and the extent of house room, that is the effect of crowding. But while admitting the existence of these localising causes of cholera, and also grave defects in drainage in many affected districts and in some close localities of cleansing also, it would scarcely be fair to pass over the question of improvement in the following statement of the officer of health. He says, "This year "has been one of distinct progress—progress in continuous execution of sanitary works and progress "in strength and grasp in sanitary control—and advance towards the accomplishment and realization "of projects of vital and supreme importance to the public health."

But the Bombay of to-day is not the Bombay of the time when sanitary works were first undertaken. The population has been augmenting with great rapidity, so that Bombay, after London, is the most populous city in the whole Empire. One result of this progress is that work has to be done not only for protecting the public health, but to guard against the results of increasing density. The fact is of importance, because it proves the need of increasing activity on the part of executive sanitary authorities.

In the meantime the house drainage connections are only in an experimental state, and the question as to the best form of domestic privies appears not to have been settled, but nevertheless a sum of 94,732*l.* had been voted provisionally for this important work. It is scarcely necessary to say that household water-supply must accompany house drainage, and that without this there can be no security for success.

12. The remarks of the officer of health on the necessity of pressing forwards with the works may be here quoted. He says, "The continuous execution of drainage sanitary works, progression in "operations and measures for the improvement or amelioration of the public health or for the public "convenience, has now become inevitable, and cannot be avoided.

"The sole responsibility arising out of the growth of the city is not confined to providing channels "for the removal of the liquid refuse; when the drainage net work has been completed, the vital "question of increasing the water-supply must be considered and discussed, and decided also; and "there is no doubt that the water-supply with all appliances and measures recently adopted for "improved and methodic distribution, is insufficient for the wants of the population at this time, and "is still more insufficient prospectively." This form of the public health problem is not peculiar to Bombay. It has frequently occurred that town improvements have been the means not only of increasing the local population, but they have led to large increase by immigration. As the case stands Bombay has apparently a great future before it, but in the meantime details of drainage and water-supply have not been completed, and as one result of this state of matters, although there has been a large reduction in deaths from epidemics, the subsoil causes appear to remain. But besides this, increase of population carries with it increase of unhealthy conditions, and amongst these perhaps the most dangerous is surface overcrowding, which of itself intensifies all causes added by increase of population. It would appear, therefore, that the arrangements, area, and construction of future buildings, as well as diminution of crowding on present areas, must form an important part of the work of Bombay municipal government, for rooting out cholera, including of course conservancy, as the measure most immediately practicable, drainage, water-supply, and surface improvements generally.

13. It would appear that in local estimation Bombay will not become poorer by its extension, for a local writer, quoted by the officer of health, makes the following statement. After showing that the increase of population to houses had risen since 1872 from less than 21 to 25 individuals per house, he says, "During this time Calcutta has remained stationary, and Madras has actually lost in "numbers, so that the increase in Bombay is all the more hopeful as to the extension of local

"industries and foreign trade, and the general prosperity of the city." This may be true, but the statistical data we have quoted of the relation of people to houses show at the same time the quarter from which danger to the prospective advance of the city may come. So long as public opinion in certain European countries accepts quarantine restrictions on commerce as an alternative to improving their own sanitary condition, Bombay will be at their mercy, unless the municipality makes the extirpation of local cholera one of its objects, and if it succeeds in this there will be nothing to fear from any other form of epidemic disease.

14. *Fevers.*—These, as elsewhere in India, are the most important death causes in Bombay. The abstracts already given show them to be of the usual types, but the peculiarity of Bombay fevers is the large preponderance of remittent fever. There were 11 deaths from enteric fever in 1881, 400 deaths from simple continued fever, 942 from ague, and no less than 5,084, or 22 per cent. of the total mortality of the year, was due to remittant fever.

The aggregate mortality from all fevers was 28 per cent. of the total year's deaths, but it only amounted after all to a death-rate to population of 8·32 per 1,000.

The health officer has given a table showing the annual fever deaths for 32 years, but the actual death-rates cannot be given because the population is not accurately known for the same years. During the earlier years of the series the annual fever deaths were from 6,000 to 8,000 a year, but in two years, 1864 and 1865, the fever deaths rose to 12,593 and 18,767 respectively. During the subsequent 11 years the fever deaths averaged from 5,000 to 6,000 in round numbers, but in 1877, the famine year, they suddenly rose to 12,832, and since then have been declining, the lowest being the 6,437 deaths of 1881. It seems doubtful if the population, including country immigrants, has altogether recovered the effects of the famine and scarcity years.

15. The prevalence of fever in different districts of Bombay shows striking differences in intensity. Thus in the "Water Division" the fever death-rate was only 1·40 per 1,000. In "Fort Southern" it was 2·27 per 1,000, from which point it rose to 5, 6, 7, 8, and 9 per 1,000. The highest rates of the year were 10·28 per 1,000 in Kara Talao, 11·23 in Mandvee, 13·84 in Pareil, and 18·72 in Sowree. There must have been some reasons for these great differences in fatality connected with the personal and sanitary relations of the people. It is not at all unlikely that in the most feverish localities most of the deaths have occurred in particular houses, and if the fact were so, the causes to be dealt with would at once be reached.

16. To show the importance of detailed inquiries into local conditions affecting the prevalence of epidemics, it will be better to introduce here the results of a distinct advance in this direction already alluded to, made by the health officer as regards the cholera of 1881, which shows the great influence of what may be called soil conditions on epidemic mortality.

Locality.	Cholera.	
	Cases.	Deaths.
Ground floor	515	391
First floor	121	90
Second floor	34	25
Third floor and above	16	16
Unknown	11	9
Boat	16	15

The facts are not new, for they have been observed in the west also, but for the first time in India the health officer has been able to show that the same law prevails in India. What is further required is to apply the same principle of inquiry to fevers, and by this means a step in advance may be possible in dealing with its etiology.

It may almost be predicted that the amount of fatal fever bears a relation to the state of the subsoil, the ground area per head of the inhabitants, its drainage, surface cleansing, air movement, and the like. It is now known that cholera mortality has a close relation to the cleanliness of localities, and the same relation may be predicted of certain fever types, and perhaps in this direction may be found an adequate explanation of the great amount and fatality of remittents in Bombay.

These are merely suggestions which present themselves on considering the data in the present Report.

17. *Small-pox.*—There were only 35 deaths from small-pox in 1881, against 207 deaths in 1880. The quinquennial mean was represented by 1,035 deaths.

Bombay is under a method of vaccination with calf lymph, and the following were the year's results:—

	Vaccinations.
Successful	17,276
Failed	1,111
Unknown	969
Total	19,356

	Re-vaccinations.
Successful	1,961
Failed	217
Unknown	52
Total	1,330

Successful vaccinations, according to age, stood as follows:—

Under one year	12,393
„ six years	4,386
Above „	497
Total	17,276

There were 16,638 births registered in 1881, so that the vaccinations under one year amounted to three-fourths of the births, but the total successful primary vaccinations exceeded the births.

Small-pox mortality was confined to 13 localities out of 31. The largest number, namely, 13 deaths, took place among 64,653 people in Camateepoora, one of the most unhealthy parts of Bombay.

The evidence in the present Report appears to show that vaccination is making head against births as well as against the small-pox deaths. But there will be less liability to small-pox as town improvements are carried out.

18. *Phthisis.*—For a number of years the relation of mortality from phthisis to local conditions has been a subject of inquiry in Bombay. In 1881 the deaths registered from this cause were 2,232, or 2·89 per 1,000 of the population.

Phthisis has been most prevalent in Kara Talao, a locality having 28,691 inhabitants, and a death-rate of 40·04 per 1,000, the highest of any populous district in Bombay. Its death-rate from phthisis for three years had been as follows:—

Years.	Ratios per 1,000 deaths to Population from Phthisis.
1879	8·29
1880	8·96
1881	6·41

and in each year the rate has been higher than prevailed in any other population group.

The place is densely built and peopled, and its population has increased 21·37 per cent. since 1872. In that year there were 8·40 square yards to each person, while in 1881 the area had fallen to 6·93 square yards for each, or 700 per acre, or 448,000 per square mile. The average population per room is 4·7 and its fever death-rate in 1881 was 10·28 per 1,000.

Kara Talao has old, badly planned underground drains, "square, imperfectly designed, imperfectly "constructed; through the imperfections of design or construction, and time and age results, and "altered building positions and street levels, or the imperfect, badly constructed, unsystematically "or wrongly designed connexions, drains flow not now freely, their circulation is retarded or "obstructed, or even regurgitation in some instances is observed . . . There are many buildings "occupied by the poorest classes, of the most unwholesome construction, so constructed that no "vital improvement is possible except through demolitions."

It is evident that this place presents a distinct sanitary problem. It is occupied by shoemakers and other outcasts, "terribly crowded, fearful mingling of human beings, hideous pollutions." It besides contains the rest house for Moslem pilgrims. Other details are given which deserve careful consideration and prompt action, but the importance of the case lies in the fact that it is typical, and shows generally those local conditions which foster epidemics in Indian cities.

19. Before concluding the disease history of the year, we shall notice the following facts bearing on the cause of guinea worm. The village Gowaree "has been dreadfully affected with this scourge," while villages on either side of it have been unaffected. The sanitary state of the villages is the same except in one particular. Gowaree has a foul well water supply, while the other villages use Vehar water. The obvious remedy is to fill up the wells and lay on Vehar water to the affected village.

20. We shall next give a brief abstract of sanitary works carried out in the course of 1881 under the usual heads.

Waterworks.—The most important work of the year was the addition of six feet to the height of the Tulsi lake dams at a cost of 5,890*l* with the view of increasing the storage by 480 millions of gallons. But in consequence of deficient rainfall the increase was only 234 millions.

Local rainfall appears to be decreasing, as is shown by the following data for Vehar area:—

	Rain, Inches.
1878	120·79
1879	76·4
1880	72·42
1881	59·10

Over the Tulsi area the rainfall in 1881 was 66·11 inches, against 93·76 inches in 1880.

The facts show the necessity of calculating areas of supplies on recurring periods of low rainfall.

The outdoor water-supply was effected by 54 dipping wells, 63 drinking fountains, 29 stand-pipes, 11 large ornamental fountains, 40 cattle troughs.

The house connexions had increased from 12,494 in 1880 to 12,817 in 1881.

Water was supplied by meter in 636 instances. The special waste prevention establishment appears to have done good work during the year. 106 mains, with a total length of 107,465 feet, were examined, of which 11 were found wasting water, three from old disconnected pipes, three from imperfect joints, and five from cracks. The total measured waste from these defects was 380,880 gallons per diem. Out of 2,254 stop-cocks examined 143 were found wasting by measure 190,320 gallons per diem. Out of 2,696 house connexions examined 1,941 were found wasting water.

The work had by no means been completed, but the actual waste was no less than 572,200 gallons per diem, or 23,800 gallons per hour.

The water saved would be sufficient at the present rate of distribution to supply about 100,000 people.

The new Bhandara reservoir was only making slow progress in the hands of the contractors, and local extension of the water-supply was much required in certain localities.

It appears to be doubtful whether considerable extension of water-supply may not be required to meet the necessities of drainage. In 1877 the water rate amounted to 31,377*l.* and in 1881 it had risen to 49,314*l.*, showing rapid increase in the household and other consumption.

21. *Drainage.*—On the 1st June 1881, the new main sewer, 4½ miles in length, "was brought "to a satisfactory completion. . . The outfall sewer was also completed." Its end was injured by the sea, and 192 feet of the rubble and concrete covering of the pipes was displaced but repaired.

The foundations of the new pumping station had been completed, and the engineer anticipated that the engines would shortly be at work. About 16½ miles out of 23¾ miles of pipe sewer had been laid. With the completion of main and outfall sewers the questions of local and house drainage were being considered as follows:—

"1. The survey and estimates for house connexions in the first portion of the sewerage scheme.
"2. The extension of the new sewerage system to Camateepoora with house connexions complete.
"3. The interception of the present outfalls in Back Bay.
"4. A new and comprehensive drainage scheme," in connexion with a flood reservoir on the flats.

In reference to the drainage extension proceedings the Municipal Commissioner says, that "as "soon as the new pumping station is ready for work, experimental house fittings will be connected "with the new sewer, and as far as the sanctioned works are concerned, it now rests with the "executive engineer to push them on with rapidity and efficiency.

"Meanwhile, there is an urgent necessity for a complete survey, in order that any local works "done may fit into the general design, and because the well-grounded complaints of the present "state of the fort and other districts named make it impossible that the remedy should be long "delayed." The execution of house drainage connexions now rests with the municipality, and it is evident from facts stated in the present report that the proper execution and maintenance of these will be about as difficult a matter as the main drainage itself.

In 1872, house connexions were executed in one of the districts, Dhobi Talao, and the officer of health describes their then present state as follows:—"I believe they have not been repaired at any "time since their construction; they are corroding and breaking, portable portions being abstracted, "and unless they are restored or repaired they will not only not perform the office they were "intended to perform but there will be no system of house connexions left in Dhobi Talao, and this "section of the city, unless provided on another system, will be in a worse position than other "portions of the city, for there will be a street exit for the sewage. Refuse waters are seen lying on "the sides of many of the streets." Dhobi Talao has a population of nearly 40,000, with a death-rate of 30·62 per 1,000. The question naturally recurs in this case, as in other similar ones, where does the responsibility lie? Is it with the administrative or with the executive authority?

The officer of health considers that it lies with the administrative, the municipality, for he says, "The moral to be derived from their condition is clear, that the duty of the municipality in house "drainage does not cease with construction of house connexions, when house connexions are made, "an equally important duty of constant supervision and repair remains." There is no doubt on this point.

The execution and maintenance in efficient action of house connexions are, as matters of sanitary principle, a portion of the drainage system of a city, and the municipality should be held responsible, not only for execution, but for their being kept in working order.

Just as house drainage connexions without water are worthless for real sanitary work, so house connexions without supervision and repair become the means of actual injury to public health. Careful supervision, inspection, and repair will always be less costly in mere work than relaying drains from neglect of repairs altogether apart from risk to the public health.

An instance is mentioned of "one fine building" in the fort in which the house connexions were originally sound, "but time acted on them, they became old, they ceased to act perfectly, and foul "gases escaped, rendering habitation of portions of the building loathsome, and of some portions "impossible. . . . . An active danger to be guarded against is the ingenious and confident "plumber."

In Nagdouree, a place where drainage is urgently required, there are 122 large cesspools receiving,

not only sewage, but surface and rain-water. As a consequence, the surface is sloppy and sometimes overflowed from cesspits.

Another evil, which we have often referred to, is the present method of removing surface water by covered drains, the cleansing of which leads to "breaking up lanes in drain clearing, destroys the "continuity of surface, and removes the possibility of clean surface appearance; lanes which are "constantly broken up can never look clean, in the unevenness created water will collect, and "collecting, will become foul and form nuisances." In 1881 no less than 202·6 miles of these covered drains were opened and cleaned.

22. Enough has been said to show that the real work of draining Bombay has yet in great part to be undertaken, but it has only up to the present time been rendered possible by the completion of main drains and outfalls.

23. *Conservancy.*—This department of health has been the one most actively carried on in times past. The average strength of the service included 2,546 men and women, 415 scavenger carts, and 90 night-soil carts. In 1881 there were collected and removed 136,867 tons of garbage, or 5,300 tons more than in 1880. The average daily removal of night-soil was 233·6 tons, against 230 tons in 1880. It is satisfactory to see that cleansing is so actively carried on.

Part of the garbage is used for filling up and reclaiming the flats, and the Commissioner says that since the practice was adopted of covering the matter with a light coating of good earth no nuisance has been experienced. But it should be kept in mind that made ground of this nature is quite unsuitable for house building. As this manner of disposing of refuse must come to an end, the introduction of the method of incineration (which is a perfectly safe process if carefully done) has been under consideration.

24. The report shows that a large amount of very useful detail sanitary work was done in the course of the year, among which may be enumerated progressive improvement in construction and regulation of cattle sheds, regulation of unwholesome trades, prevention of nuisances, &c.

An attempt has been made in growing *eucalypti* on the Tardeo flats, and hitherto with some small appearance of success. The experiment is quite worthy of trial. In a former memorandum we gave some account of the methods of culture which had been successfully adopted in Algeria.

25. These appear to be the chief points calling for notice in the present year's Bombay report. They show that real progress is being made in rooting out the epidemic disease causes in the city, but that in some directions, especially as regards drainage, there appears to have been little done, when compared with the long time which has elapsed since the question of drainage was first under discussion.

It is satisfactory to learn that the outfalls have been completed, and that it is now possible to drain districts and houses, but past experience in these matters has clearly shown that current daily superintendence of works in execution, and subsequent careful supervision of the entire details of the drainage system, must form an essential part of these works. Water-supply will have to be increased, but no better illustration could be given of the true economy of daily oversight than has been exemplified by the results of water inspection, whereby, even at present, an amount of water has been saved sufficient for 100,000 people at the present supply rate. Let this same care be systematically applied to the drainage details, and a similar large economy in the cost of repairs will result.

We cannot conclude this analysis of the officer of health's excellent report without stating that the quarantine proceedings lately adopted at Suez against clean arrivals from Bombay were wholly unjustified by the year's sanitary history. These proceedings were based on no facts, and the adoption of them showed an apparent want of knowledge of the real causes of cholera.

12th July 1883.

No. 15.

MEMORANDUM of the ARMY SANITARY COMMISSION on the following PAPERS relating to the HEALTH of EUROPEAN TROOPS serving in MADRAS PRESIDENCY in 1881:—1. HEALTH RETURNS of BRITISH TROOPS, together with a REPORT by the SURGEON-GENERAL, HER MAJESTY'S FORCES. 2. REPORT of SURGEON-GENERAL on the HEALTH of BRITISH TROOPS, together with HIS EXCELLENCY the COMMANDER-IN-CHIEF'S REMARKS thereon. 3. REPORT of SURGEON-GENERAL, HER MAJESTY'S FORCES on ENTERIC FEVER among BRITISH TROOPS in the MADRAS COMMAND, for 1881.

These three reports have been referred separately to the Commission, but as they all refer to the same subject, we shall discuss them together.

1. The average strength of British troops in 1881 was 10,389 non-commissioned officers and men, among whom there were—

		Per 1,000.
Admissions to hospital	11,989 =	1154·
Deaths	114 =	10·97
Invalids	286 =	27·53
Average daily sick	663 =	63·82

2. The following were the chief admission and death causes during the year:—

	Cases.	Deaths.
Cholera	33	18
Small-pox	9	1
Enteric fever	9	6
Intermittent fever	2,474	—
Remittent fever	51	1
Continued fever	371	1
Apoplexy	24	16
Delirium tremens	51	1
Dysentery	337	12
Diarrhœa	455	2
Hepatitis	401	16
Respiratory diseases	510	4
Heart disease	—	6
Phthisis pulmonalis	74	8
Anæmia and debility	—	1
Wounds and accidents	1,078	1
Venereal diseases	2,684	—
All other deaths	—	26

3. The reports themselves are chiefly of a departmental character, and several of the more important sanitary questions are included in the report of the Sanitary Commissioner for Madras Presidency, which we have discussed on other papers. There are, nevertheless, some facts which have an important bearing on the sanitary condition of Madras European army, which may be noticed in the paragraphs which follow.

4. Among these is the following abstract, in which the health of troops in 1881 is compared with corresponding data for the preceding 10 years:—

Ratio per 1,000 Strength.	1871–80.	1881.
Admissions	1231·01	1154·01
Deaths	16·55	10·97
Invalids	41·09	27·58

By adding together the deaths and invalids it will be seen that the average 10 years' loss from both causes was 57·64 per 1,000, while in 1881 the loss was only 38·59, showing a saving of nearly 2 per cent. of the strength. Of course, this is only for one year, but the death-rate of 1881 includes 17 deaths from cholera against a single death during 1880.

5. *Cholera.*—The entire cholera mortality of the year took place at the following stations:—

Stations.	Cholera cases.	Cholera Deaths.
Secunderabad	3	—
Kamptee	25	14
Thyetmyo in Burma	5	4

These figures are from Dr. Stephens' report, and contain one death more than the number given by the Surgeon-General. In Madras Presidency itself the whole cholera mortality of the year was *nil*. There were 14 deaths among Madras troops at Kamptee, in the Central Provinces, which the facts stated by the Sanitary Commissioner for the Presidency appear to show were due to flooding of surface and subsoil, and possibly to bad water, besides which the station itself is situated within the region in the Central Provinces where cholera was epidemic in 1881. The Thyetmyo cases took place in a well-known cholera endemic locality. In Madras Presidency itself there were 9,446 cholera deaths among the civil population; there were 22 deaths among Native troops, 12,485 in number, and 33 deaths among 10,332 prisoners in Madras jails. The only cholera among 6,442 British troops at the Presidency stations were three non-fatal cases at Secunderabad. It cannot be said that this comparative experience was other than satisfactory.

The purely local character of the Kamptee outbreak was shown by the cessation of cholera on movement of the troops.

6. *Enteric Fever.*—According to Dr. Stephens' tables there were nine cases and six deaths from enteric fever in 1881, including possibly a death out of hospital. The Surgeon-General's report gives nine cases and five deaths. The difference in this case is in an additional death at Thyetmyo (two deaths instead of one).

The facts as regards Madras Presidency stations were as follows:—

Stations.	Enteric Fever.	
	Cases.	Deaths.
Bangalore	2	2
Wellington	2	—
Secundetabad	2	—
Kamptee (Central Provinces)	1	1
Rangoon (Burma)	1	1
Thyetmyo (Burma)	2	2
Total	9	6

At the three Madras stations there were thus only five cases of enteric fever, and the two deaths were yielded by one station, Bangalore. The proportions of cases at different stations vary from year to year. In 1880 there were 13 cases at Secunderabad and 10 at Kamptee.

In 1881, out of 879 soldiers' wives and 1,552 children, there was one non-fatal case of enteric fever in a woman. The milk consumers escaped the disease. There was one fatal case in a Native soldier at Secunderabad.

7. The Surgeon-General places the possible causes of predisposition to enteric fever in the following order:—

(*a*) Propagation by a specific poison in air, water, or food.
(*b*) Spontaneous generation by sewage emanations and putrefying organic matter.
(*c*) High temperature acting on young constitutions unaccustomed to such heat.

But then we have enteric fever occurring among Native troops in which the last of these causes can scarcely be assumed as sufficient, and hence, as Sir Anthony Home puts it, "the question is "brought back to one of efficient conservancy, if it has really ever got adrift from this."

With reference to this view the Surgeon-General states that, in 6 out of the 9 cases of enteric fever recorded in 1881, the attacks could not be connected with insanitary conditions, but that in one case at Secunderabad the man had been sleeping near a latrine, and in another case at Thyetmyo an adjacent cesspool might have been the cause. Up to the present time enteric fever among British troops in India has not been proved to result from any single cause. Statistical facts certainly point to a maximum of predisposition to attacks of this fatal fever being present among men of young ages, and of recent arrival in India. At this point the question of rapid change of climate, and its consequences to such subjects, must be admitted as of great importance. But we have also long experience at home and in other countries to prove that putrid emanations may lead up to fevers of this type. Much has been done in India at all stations to remove local causes of this class, but the great general cause, namely, malaria, remains, and we cannot better conclude this discussion than by inserting the following fever experience for the last 11 years in Madras Presidency. The figures and fractions are for annual average numbers, not ratios:—

Years.	Average Strength.	Simple Continued Fever.		Febricula.		Remittent Fever.		Ague.		Enteric Fever.		Total.		Ratio per 1,000 Strength.	
		Admission.	Died.	Admission.	Died.	Admission.	Died.	Admission.	Died.	Admission.	Died.	Admission.	Died.	Admission.	Died.
Average from 1871 to 1880.	11,032	831	4·1	491	·1	176·8	3·3	1,413	0·1	39·3	13·9	2,952	21·4	267·6	1·94
1881 - -	10,389	866	1	361	—	56	2	2,113	—	9	5	2,905	8	279·6	0·77

This table shows an increase over the average of ague of 700 admissions in 1881, but in all other fevers there has been a marked reduction in admissions. The general fever death-rate had also largely fallen off, especially as regards enteric fever, which nevertheless still occasioned five eighths of the fever deaths in 1881. Remittent fever had diminished in frequency and fatality, as had also continued fever. Looking at the facts generally they appear to show that, while the underlying malarial cause of fevers in India had remained much as usual, what may be called the aggravating causes which tend to determine the fever types, and consequently the mortality, had largely ceased to act at the stations.

These causes are all those connected with defects in drainage, conservancy, and water-supply, which we know from other reports have been actively dealt with at a number of stations, and the argument derived from the whole experience is that sanitary work has saved life and ought to be actively pursued, together with drainage, to lessen or remove malarial conditions. Sir Anthony Home's view, already cited, is therefore correct, and we may conclude by citing the following words of the Surgeon-General by way of practical application:—"In closing these remarks, "it may be observed that it is not probable that any ordinary insanitary defects likely to have "caused enteric fever have been overlooked, as the occurrences of a case is the signal for increased

" vigilance and extended inquiry. At the same time it must be stated that the men are exposed " to one source of danger beyond control—I refer to the risk they run in frequenting offensive " bazaars, and often eating and drinking there articles of the most unwholesome quality."

All this is no doubt true, but the question arises as to whether the time has not arrived for dealing with villages and bazaars in the vicinity of stations all over India. These places are a menace to the health of troops. Why should Wellington, situated in one of the healthiest climates in India, continue to furnish cases of enteric fever, and why should the Ulsoor tank at Bangalore still be permitted to risk the health of troops by its impure water collected from a foul gathering ground? In hot climates we must not always expect disease causes to assume the same apparent magnitude as they do in England before health is sacrificed. The vast importance of apparently trivial causes in India was long since pointed out by the Royal Commission on the Sanitary State of the Indian Army, and this principle must never be lost sight of in dealing with Indian sanitary problems.

8. *Venereal diseases.*—Admissions from this class of diseases amounted to 258·3 per 1,000 strength. The Surgeon-General states that the admissions under this head do not appear to be greatly influenced by lock hospitals, and no doubt the following explanation of this circumstance is correct. He says:—"This is due to the fact that the Contagious Diseases Act does not in any town reach " more than a fraction of the women actually amenable to its control, and to the circumstance that " clandestine prostitution is universally prevalent." This is the latest re-statement of causes of want of success in the operation of the Acts, and it merely repeats what has been said year after year.

The relation of the amount of venereal disease among troops to prevalence of clandestine prostitution has often been under consideration by the authorities in India, and various methods of dealing with the question have been tried, but hitherto without apparent advantage. The whole subject is, however, in the hands of the Government of India.

9. *Sanitary defects at stations.*—The chief complaint in the present report lies against the old Black Town drain at Madras, which discharges into the sea near the north-east angle of Fort St. George, and causes great nuisance to the occupants. "But the municipality are apparently " taking steps to relieve the residents of the Fort of the offensive odour." The Fort drain is also at times offensive. Both these nuisances are perfectly gratuitous, and we can only express surprise that they still exist.

10. The following improvements are enumerated in the Commander-in-Chief's letter:—

The new Royal Artillery barracks sanctioned for St. Thomas' Mount have been commenced.

The new Artillery barracks at Trimulgherry are very nearly completed, and the men would have been moved into them from the old bad bomb-proof barracks by the end of the year.

The barracks at Tonghoo, which had been damaged by a storm, were under repair, at a cost of 3,500*l.*

Hospitals at Kamptee, Rangoon, and Tonghoo were to be proceeded with when funds were obtained.

Masonry drains were provided for bath rooms and wash-houses of the Royal Artillery Barracks, Trimulgherry.

Steps were being taken to improve the water-supply of Madras Hospital.

The Surgeon-General reports that latrines are generally constructed on the dry-earth system, and are fairly attended to.

Lastly. Although the present report is chiefly statistical in its character, it contains evidence of sanitary work having been successfully done in past years, and the result has apparently been a very considerable improvement in the health of troops for the year 1881. In a country like India, however, with its tendency to epidemic outbreaks, the real test of improvement must be sought in comparing the ratios of mortality from epidemic diseases of troops and civil populations in their vicinity, during epidemic years. Again, the year's experience, like that of many others, proves that apparently high epidemic death-rates may really be due to particular stations, showing that it is on these stations that sanitary effort should be spent. If Kamptee, for instance, in the Central Provinces cannot be improved, the question naturally arises whether it should be occupied at the sacrifice of a large loss from epidemics. The site appears to be unfavourable.

But, as a whole, the year's loss from epidemics has been small, and the real loss has been inefficiency from prevalence of malarial fevers, the causes of which in most cases are purely local, and, as such, admit of mitigation by known engineering measures. The application of these, together with what the Surgeon-General so well names "increased vigilance" in dealing with defects in conservancy, are the practical lessons of the present year's report.

11th July 1883.

No. 16.

Memorandum of the Army Sanitary Commission on the Medical History of the European Troops in the Bombay Command for 1881.

1. The trooping service during the year 1881–82 was carried out from England and Natal to Bombay by the usual troop-ships assisted by two hired transports. There were in all 13 outward voyages, and in the course of the season there were embarked the following numbers for India :—

Officers	688
Ladies	134
Children	141
Men in health	9,988
Women in health	358
Children in health	441
Female servants	25

Of these outward voyages three commenced from Natal.

2. Out of these strengths of men there were 765 admissions to hospital, and three deaths, one from rheumatism, and two from pneumonia. Among the admissions there were from—

Primary syphilis	145	= 180·3	per 1,000
Secondary syphilis	18	= 22·4	,,
Gonorrhœa and its results	157	= 195·2	,,
Total	320	= 397·9	,,

Admissions under these heads formed no less than 37·2 per cent. of the total admissions. At the conclusion of the voyages 81 cases of primary syphilis were transferred to hospital on arrival at Bombay.

This renewed experience of 1881–82 has called forth the following remarks from the Surgeon-General, who says that "in some cases it is quite possible the disease may not have manifested itself "until after the troop ship had proceeded to sea, but there is little doubt that many might have "been detected by efficient inspection prior to embarkation."

It is necessary, however, to repeat here that in reply to a similar complaint in the preceding year, the Army Medical Department stated that "not a single man suffering from these complaints was "embarked for India."

3. We must further call attention to the fact that 56 cases of itch appeared on board.

4. Among children there were four deaths from diarrhœa and one from bronchitis.

5. Of the total number of officers and men embarked for India, 423 officers and 7,445 men left at dates which would enable all to arrive in India before the hot weather, but most of them in the cool season. The first departure from England was on the 19th October, the last on the 13th April.

6. On the return voyages from India the embarkations at Bombay were as follow :—

Officers	466
Ladies	132
Children	267
Men in health	7,499
Women	595
Children	1,179
Invalids, men	1,860
Women	142
Children	348
Insanes	83
Convicts and bad characters	176

The dates of departure from Bombay show that the greater number of invalids would arrive in England in the mild season.

With the single exception of the occurrence of venereal diseases on board, the facts as regards health of troops show that the service of the year was well performed.

7. The following are the principal data connected with the sanitary state of European troops in Bombay Presidency in 1881 :—

Strength	9,986		
Admissions	17,156	= 1718·0	per 1,000
Deaths	127	= 12·72	,,
Constantly sick	673	= 67·38	,,

The admissions and deaths when compared with the previous ten years' averages, which were respectively 1,565·1 and 17·01 per 1,000, show a considerable increase of sickness and a large reduction in the death-rate. The constantly sick were 56·81 per 1,000 during the same ten years, against 67·38 for the year under review, but these ten years included the Afghan war, in which part of the Bombay army was engaged, and suffered accordingly, as may be seen from the average rates for 1879–80, which were as follow :—

Admissions	2,125·9	per 1,000
Constantly sick	72·46	,,
Deaths	20·72	,,

The Bombay European army had apparently not recovered from the effects of field service at the latest dates.

According to Dr. Stephens' statistical tables appended to Dr. Cuningham's report for 1881, the strength of the Bombay European army, exclusive of troops serving in Afghanistan, was 9,895, and the following abstract gives the admissions and deaths from the chief disease causes among this number in 1881 :—

Diseases.	Cases.	Deaths.	
		Total.	Per 1,000.
Cholera	6	3	0·30
Enteric Fever	42	28	2·83
Intermittent	7,465	—	—
Remittent	302	9	0·91
Continued	551	—	
Apoplexy	27	12	1·21
Delirium tremens	21	—	—
Dysentery	232	18	1·82
Diarrhœa	564	3	0·30
Hepatitis	285	15	1·52
Spleen disease	55	1	0·1
Respiratory and phthisis	998	14	1·42
Rheumatism	392	—	2·42
Venereal diseases	2,586	—	
Wounds and accidents	1,050	—	
All other causes	3,060	30	

The deaths in this list include three suicides and two deaths out of hospital, not included apparently in the Surgeon-General's table, which gives the hospital deaths only.

9. The cholera cases took place, two at Ahmedabad, two at Baroda, and two at Poona and Kirkee, and there was one death in each locality. The total cholera death-rate was 0·30 per 1,000, which may be compared with the rate among the civil population of Bombay Presidency, viz., 1·01 per 1,000 and that among native troops, which was 1·35 per 1·000.

10. The most important fever death cause of the year, enteric fever, furnished, according to the Surgeon-General's table, 34 admissions and 19 deaths, at the following stations :—

Stations.	Cases.	Deaths.
Aden	2	2
Karachi	1	—
Hyderabad	1	—
Poona	13	7
Ahmednagar	2	1
Deesa	2	1
Mhow	5	4
Nusseerabad	6	3
Taragarh	1	1
Total	34	19

It will be seen that there is a discrepancy in the figures between the two tables, and when the stational return in Dr. Stephens' statistics is compared with that given by the Surgeon-General, the following differences present themselves :—

	Cases.	Deaths.
Mhow	5	4
Karachi and Ghizree	7	6
Poona and Kirkee	16	10

The localization of enteric fever, according to Dr. Stephens' list, therefore stands as follows :—

Stations.	Strength.	Enteric Fever.	
		Cases.	Deaths.
Nusseerabad	637	6	3
Mhow	1,427	5	4
Deesa	225	2	1
Karachi and Ghizree	679	7	6
Hyderabad	385	1	—
Aden	758	2	2
Ahmednagar	441	2	1
Poona and Kirkee	1,917	16	10
Taragarh	48	1	1
Total	—	42	28

These discrepancies, no doubt, admit of explanation, but we must accept the figures as showing the comparative liability of stations to enteric fever in 1881.

In the reports on the stations there are no facts mentioned which would account for the varying amount of enteric fever at them, but, as we shall see, there are conditions of a general nature present which might predispose troops to fever attacks without reference to type.

11. The most important admission cause of the year was malarial fever, the liability to which for three consecutive years at all the stations is well shown in this table prepared by the Surgeon-General :—

Stations.	Admissions per 1,000 Strength from Malarial Fevers.		
	1879.	1880.	1881.
Bombay	601·8	506·3	456·4
Deolali	1281·0	641·7	539·5
Belgaum	573·7	368·5	650·3
Aden	88·6	528·9	125·8
Karachi and Ghizree	1668·4	1764·3	667·6
Hyderabad	1201·0	932·9	849·7
Sukkur	—	500·0	1000·0
Poona	1202·3	1037·6	527·3
Khrkee	1246·5	899·5	396·0
Ahmednagar	1207·8	1271·4	541·8
Satara	1479·7	499·9	110·4
Kolapur	—	—	754·4
Purandhar	1258·9	698·8	716·8
Khandala	651·6	1113·6	1101·4
Mhow	1451·6	1871·8	802·1
Indore	1552·5	1715·9	608·7
Asirgarh	1475·7	2696·4	871·0
Neemuch	3207·8	1817·9	1125·6
Nusseerabad	1327·2	447·2	758·4
Deesa	334·9	1135·3	902·4
Ahmedabad	984·5	1052·8	558·6
Baroda	2078·2	2262·6	1522·4
Tatagarh	1978·7	1363·6	560·0
Mount Aboo	1437·5	1318·8	2871·0
Thal	—	125·0	250·0
On march	179·4	248·1	790·1

One satisfactory point in this table is that it shows a very considerable reduction in fever liability in 1881, at most stations. It shows that certain stations have fever-rates persistently higher than others, and of these Mount Aboo, Baroda, Neemuch, Mhow, Asirgarh, and Indore require to be improved. As often happens, troops on march suffer less from fever than troops at stations, and the three years' experience appears to point to the existence of purely local fever causes, probably modified by local climates and topography.

12. We shall next abstract briefly the information in this Report on the condition of stations, as it contains points of some importance.

Much discussion has arisen as to the causes of fever among troops at Colaba, Bombay, and if the fever statistics can be trusted, we have got a step nearer to the cause. The Surgeon-General states that there are two assumed causes of fever at this station,—(1.) An extensive mangrove swamp to windward. (2.) Damp subsoil and generally inferior infantry barracks. "The new Artillery "barracks," he says, "with one exception, stand on comparatively high ground, while the old "infantry barracks are situated on low-lying land to the north-west of the road, and between this "and Back Bay mangrove swamp. . . . . The water-logged condition of the ground on which "the infantry barracks stand is a well-known fact. During the rainy season, indeed, it is little "better than a swamp, while its physical conformation is exactly calculated to cause the retention "of subsoil water." Besides being on higher ground, the Artillery barracks "are raised on high "solid stone plinths; they are dry, lofty, and well ventilated. The plinths of the Infantry barracks, "on the other hand, are barely raised above the surface of the ground, they scarcely deserve the "name of plinths, the floors are necessarily damp, and the rooms are low and dark." There is, however, one block of the Artillery barracks which stands on lower ground than the other five. The following is the proof of the influence of local position and bad barracks on fever prevalence,—the infantry suffer more from fever than the artillery, and the lower block of the Artillery barracks has more fever proportionately than the five which are better placed; and then as regards the mangrove swamp, it is argued that these facts and the amount of fever at certain seasons tend to show that the swamp has not been the cause of the fever attacks at Colaba. It may be asked, on the other hand, whence comes the fever in the Artillery barracks? The Surgeon-General has shown ample cause for fever prevalence being greater in the Infantry barracks, but the facts scarcely show that the swamp has nothing to do with it. It is satisfactory to learn from the papers that new barracks will be built.

13. This station affords a curious illustration of the substitution of one sanitary defect for another.

It appears that the Sanitary Commissioner had advised the filling up of cesspits which formerly received the refuse water, and recommended that the water should be drained away instead. Now some 18 years ago we had laid down in our "Suggestions" that work of this kind was to be carried

out either by pipe drains or by surface drains, formed of impervious material. In the Colaba case the cesspits were very properly abolished, but it cannot be said that dry rubble gutters from which the refuse water "soon soaks into the ground" was any improvement on the former practice. We must refer to the last edition of our Suggestions of 1882 for the principles on which work of this kind should be carried out.

The hospital at Colaba appears to be no better than the Infantry barracks, but it is some satisfaction to be informed that a new hospital will be built when the barracks are reconstructed.

14. *Aden.*—In our Memorandum on the Report of the Sanitary Commissioner with the Government of India, we have quoted from Surgeon-General Gilborne's report the account given of the Somali villages at Aden in relation to the occurrence of cholera among the people after the arrival of the "Columbian" from Bombay, and the consequent imposition of quarantine at Suez. We shall only here refer to the facts in their relation to the sanitary state of the garrison. One village, Maala, is described as "the place where contagious maladies usually originate, and to which they "cling longest," and the Deputy Surgeon-General considers this village to be "a standing menace "to the health of the garrison." In Colonel Pottenger's letter on this report it is stated that "the "condition of affairs at the village of Maala had undergone a radical change." It had been apparently mostly removed (date 14th October 1882). Another objectionable feature, namely, a mud bank at Front Bay, could, it is stated, be easily removed. The only remark which appears to be called for is, that in such a position as Aden occupies scrupulous attention should be bestowed on all these matters, as they involve not only the health of troops, but the interests of the great commercial marine which touches at Aden. Such a thing as the outbreak of cholera and bowel diseases among the Somalis ought not to have occurred, and in such an isolated locality the object of sanitary work ought to be to eradicate every unhealthy corner where zymotic disease might find a resting place.

15. *Karachi.*—In our remarks on the Report of the Sanitary Commissioner for Bombay, we have discussed the local conditions which in times past have made Karachi one of the most feverish localities anywhere. The most obvious cause is the universally recognized presence of a large swamp to windward. The Surgeon-General doubts the paramount influence of this swamp, but he states other important local causes which have several times been brought to notice; such are, "subsoil "dampness, sudden depressions of temperature, excessive barrack ventilation, inattention to "personal hygiene, night duties, indifferent drinking water, and immature soldiers. The Sudder "bazaar, which is close at hand, is in a decidedly insanitary condition; it contains a large number "of cesspools, and altogether must be regarded as an additional source of danger to the health of "troops."

Some of these disease causes cannot be altered, but a damp feverish locality to leeward of a large swamp, where troops have year after year suffered intensely from fever, appears to suggest the removal of as many men as possible to Ghizree as a matter for earnest consideration. A few wooden huts well raised above the ground there, with free ventilation below the floors, would soon enable the Karachi fever question to be settled. The Surgeon-General states, that men whose health has suffered at Karachi as a rule quickly improve in health and strength at Ghizree. Then why should it be necessary to injure the men at Karachi before sending them to Ghizree?

16. *Poona.*—The present report contributes a further part of the sanitary history of Ghorpuri barracks as follows:—"The persistent and excessive unhealthiness of the Ghorpuri barracks has at "length led to their being abandoned, for a time at least." The 1st Battalion Rifle Brigade was so weakened during seven months' occupation from the effects of malaria that they had to be sent to Wanowri, Kirkee, and Ahmednagar. The result was "most satisfactory," "in an incredibly short "time the men shook off the tendency to ague, and the number of sick fell to just one half, thus "proving conclusively that the unhealthiness of Ghorpuri barracks is due essentially to local "causes."

We discussed the sanitary problems connected with these barracks so fully in last year's memorandum on the Surgeon-General's report, that it will be sufficient to quote the following confirmatory statements about them from the report under review. Subsoil dampness, he says, does not exist at Ghorpuri to the extent of water-logging the subsoil, "but in the form of damp foundations and "floors. The facts that the floors of the old barracks are only just raised above ground level and "have drains underneath, which latter, although meant for carrying off waste water, are little better "than receptacles for filth, speak for themselves. Occasionally, too, the locality and its buildings "are seen in the early morning to be shrouded in fog, a circumstance which points clearly not only "to damp and chill air but to damp earth. The site too is low, and the Officers' quarters and "patcherries stand on black cotton soil, which is well known to be retentive of moisture. We "have here most of the conditions of a malarious locality. We have damp, and its concomitant "chill, while the barracks are so constructed as to allow these two disease producing causes the "utmost free play." The practical result of the whole discussion is a proposal by the Government of Bombay to abandon these badly placed, badly constructed barracks, and to erect new Infantry barracks at Kirkee; and we only hope that, on the facts of the case, which year after year have been so clearly stated by medical officers, this proposal may be carried out, unless the decision of the Government of India to leave the barracks unoccupied for several years, to remove the recognized defects, and then to occupy them tentatively, should be attended with success.

17. *Mhow.*—The following statement is of importance:—"The ground immediately to the south-"west of the Infantry barracks, which becomes a marsh in the rainy season, and is supposed to be

" the chief source of the malarious fevers from which the Infantry at Mhow suffer so much, has been " drained and planted with trees. It will be instructive to observe whether this measure is followed " by any permanent reduction in the number of admissions from fever amongst troops quartered in " the barracks in question." We quite concur in this view. The facts could no doubt be obtained year by year from the admission records.

18. *Neemuch.*—No further facts have been obtained to show why this once healthy station should have become one of the most feverish in India. In a former memorandum we called attention to damp undrained ground to windward and to open nullahs as probable causes. It is clear that there must be a local cause.

19. *Nusseerabad.*—Statements of various contradictory kinds have been made about this station. Insanitary locality has been affirmed and denied as a cause of fevers there. But we are disposed to accept the following account of the Surgeon-General as part at least of the facts of the case. He says, " The cantonment is situated on ground slightly elevated above the surrounding flat sandy " district. The drainage should be naturally good, but it seems that in the rainy season the surface " drains are unable to carry off the water properly. Much of it is thus allowed to sink into the " ground. An improved system of surface drainage would therefore appear to be necessary." But on the other hand the Executive Engineer says that he considers the surface drainage of the lines occupied by British and Native troops, and also of the officers lines, at this station is as perfect almost as it can be made. He denies that water accumulates after rain. It disappears into the subsoil an hour after rain, and any obstructions of surface drains are cleared away. The only questions we can ask are these. May not the malaria producing cause lie in the absorbent subsoil itself, and may not this be a case where subsoil drainage would afford the required remedy? The question of water-supply at this station has been discussed on other papers.

20. *Baroda.*—This station was occupied in 1881 by a small garrison, only 296 men, from among whom there were 478 admissions from fever. The fever-rate was 2320·4 per 1,000, out of a total admission-rate of 3936·9 per 1,000. The Surgeon-General states the local fever causes as follows:— " Insufficient surface drainage, old and ill-constructed barracks, the floors of which are on a level with " the ground. Surface of cantonment flat, with a porous soil and impermeable subsoil. During the " rainy season the surface drains are altogether unequal to the removal of the water, which accord- " ingly collects in pools, and eventually soaks into the ground." The barracks have been condemned, but cannot be replaced at present for financial reasons. This much, however, may be safely predicted of any future barracks, that unless a better site be obtained or the cantonment is thoroughly under-drained, no amount of new barrack building will keep off fever. And this consideration leads to a suggestion that the effect on the site of thorough subsoil drainage might possibly be tried at once. It would not cost much, and if the work were well done and successful it would come into use also when the new barracks can be built.

21. These are the chief points connected with stations of British troops which appear to call for remark.

They do not include other instances in which improvements are advised by the Surgeon-General. These appear to have been dealt with as far as practicable, and it is evident that the authorities have been desirous of acting on the advice of their officer so far as they had means at their disposal.

We shall next introduce a few remarks on diseases connected with the personal habits of the men, beginning with—

22. *Venereal Diseases.*—As already stated, there were 2,586 admissions under this head, equal to 261·3 per 1,000, which was a shade above the average for the whole Indian Army, namely, 260·5 per 1,000. The Bengal admission-rate was 275·8, and the Madras rate 258·3. The Surgeon-General considers that the ratio for Bombay might be lowered if lock hospitals were opened at every station, efficient police supervision "largely increased," and the area of the Acts extended, so as to bring neighbouring villages under the Acts. We have stated what appear to us to have been the statistical results of similar measures all over India on other papers, and it is unnecessary to discuss the subject further. But as the Surgeon-General has advocated their extension at Bombay stations, it may enable some opinion to be formed of their probable efficacy if we give the admission-rates for the Bombay European army under the operation of the Acts, as follows:—

Years.	Venereal Admissions per 1,000 Strength.	Years.	Venereal Admissions per 1,000 Strength.
1870	184	1876	179·6
1871	160	1877	197·3
1872	148	1878	216·4
1873	179	1879	258·9
1874	164	1880	256·3
1875	165	1881	261·8

These are the results of 12 years' application of the Acts.

23. *Intemperate Habits.*—These, as is well known, are fostered by the present canteen system under which, as stated by the Quartermaster-General, Bombay, and quoted by us last year, the young soldier is " taught to drink spirits." The Surgeon-General, on the other hand, reproduces an

old argument, which was disposed of nearly 20 years ago by the Royal Commission, that it is better to provide good rum at the canteens to keep the soldier from providing himself with bad liquor elsewhere. We are very glad, however, to find that the Surgeon-General prefers light wine or light beer for canteens, and that he objects to porter as too heavy for the climate. This reform with the abolition of spirits in canteens and bazaars, as advised by the Royal Commission, would meet the case completely, and nothing less should be aimed at.

24. *Diet.*—It has been long known that the dieting of troops in India was carried out without due regard to the requirements of health. The subject was fully discussed in our memorandum on last year's Bombay report, with special reference to representations made on the subject by the Government of Bombay.

The present practice is described by the Surgeon-General, as follows:—"Breakfast at 8.30, "dinner at 2.30, and tea immediately after evening parade. In many cases the soldier partakes of no "solid food from dinner time one day to breakfast the next morning, and in the interval may have "to go through night duty or morning parade. . . . . It is a matter of common experience "that exposure to night air in this country is a fruitful source of malarious attacks, and there is "little doubt that an empty stomach lessens considerably the power of resisting the malarious "influence." He advocates an early meal of cocoa and biscuit, and states that improved health followed its adoption in the North Staffordshire Regiment at Karachi last year. What is really required is a readjustment of the ration scale both as to articles and daily distribution.

We have often discussed the subject, and cited the experience of the French Army in Algeria, in which the ration is divided on physiological principles, and with excellent results as regards health. But there are certain additional points raised in a letter of the Adjutant-General in a Government letter (Bombay Castle, 11th January 1883, Military Department, No. 166), which require notice. After reciting the present ration, he says, "It should be borne in mind that in former days, that is, "before the introduction of the short service system, it was the exception to find a growing lad in "the ranks in India, and as the old soldier did not require so much nourishment as his younger "comrade, the ration taken as a whole was sufficient for the wants of a 'troop or company.' But it is found to be insufficient, "more especially in these days of young soldiers. The remedy must "therefore be sought for in an increased quantity of food, and his Excellency the Commander-in-"Chief concurs with the Surgeon-General in considering such increase absolutely necessary in order "to secure four meals a day to the European soldier in India."

Now that the question has been officially raised it might be well to settle it once for all. The military and medical authorities in India could do this without difficulty. We would only state one or two obvious principles to be kept in view, as these were brought out by the Royal Commission of 1863:—

1st. There should be a morning meal before early parade. The best of all meals for the purpose would be well made coffee with bread broken up in it, and eaten with a spoon, as is done by French soldiers.

This practice was stated by the Conseil de Santé of the French Army to the Commission sent to Algeria by the Marquis of Ripon in 1865–66, as an important cause of improved health of the army there.

2nd. Again, is it not contrary to physiological law to give the soldier the heaviest meal of the day at 2.30, before the setting in of the heat, when he least requires it? And would it not be better to divide this meal so that part might be eaten in the afternoon?

3rd. It is clear that where night duty has to be undertaken there should be a meal of some kind consumed before it is entered on.

Lastly, if any increase in the amount of food is to be made, it may be suggested that the addition should take place in the vegetable and farinaceous elements.

25. Under the head of *General Remarks* the Surgeon-General has discussed the various influences connected with stations, barracks, habits of men, inexperience of young soldiers, of the precautions required in Indian climates, &c., in their several bearings on the health and efficiency of the Bombay European Army. The whole of these remarks deserve the careful consideration of military and administrative authorities. Within a short compass many important principles will be found discussed, and the whole forms a fitting conclusion to this interesting and useful Report.

12th July 1883.

No. 17.

Memorandum of the Army Sanitary Commission on Reports of Fairs and Festivals held in Madras Presidency in the latter part of 1881 and in 1882.

1. These papers give in a very brief and not altogether satisfactory form, the dates, attendance, and consequences to health of 33 fairs and festivals held in districts of Madras Presidency, seven of which only took place in 1881, and the remaining 26 took place in 1882, in regard to which year we have no account as yet of cholera in Madras, and it is therefore impossible to estimate the relation of health of pilgrims to that of the surrounding civil population. The data in regard to the seven festivals held in 1881 may be stated as follows:—

2. *Tirupati*, in North Arcot district. This festival was held between the 25th September and 4th October 1881 on a hill beyond the jurisdiction of the Madras sanitary authorities.

The water-supply was "very bad," a foul tank was used for all purposes. No suitable sanitary precautions were in force. The sacred food sold to pilgrims was "unfit for human consumption." No case of cholera ascended the hill, but three cases were treated among pilgrims who had been there, the first on 6th October, as stated by the hospital assistant. Between 3rd October and 31st December there were 494 cholera deaths in North Arcot.

Under the insanitary conditions stated, it is not matter of surprise that pilgrims suffered. Between the same dates cholera prevailed more or less in 15 out of 48 districts in the Presidency. There were 12,000 pilgrims present at the festival, and there was no proof that they spread cholera any more than that it was spread by other people. North Arcot yielded some of the deaths due to the second cholera outbreak of the year a few days earlier than other districts; this is all that the facts teach us.

2. *Subbramanya* festival was held between 20th and 28th November 1881 in South Canara, in which there were 77 cholera deaths in November and December. There were 2,500 people present. Sanitary precautions were adopted, and there was no cholera at the festival.

3. *Dharmastâla* festival was held between 14th and 24th November, also in South Canara. Water-supply was guarded and latrines and trenches provided, nothing is said about cleanliness; 10,000 people attended, and after the fair was over there were three cases of cholera.

4. *Guruvayur* festival, Malabar district, 15,000 people attended. Sanitary precautions were adopted, and there was no cholera. There were only 19 cholera deaths in Malabar.

5. *Kolur*, in the same district, was attended by 20,000 people; similar precautions were adopted and there was no cholera.

6. *Sriringam* festival was held in Trichinopoly district, between 21st of December 1881 and 10th January 1882, and in this district between 19th October and 31st December 1881 there were 1,804 deaths from cholera.

Sriringam town has a population of 18,665. The number of pilgrims is not stated, the usual sanitary measures carried out in the town were enforced. Between the 11th November and 30th December there were 24 deaths in the town from cholera, 12 of which took place during the festival, but there are no data to enable the relation of the pilgrimage to cholera to be traced.

7. *Chidambaram* festival in South Arcot was attended by 5,000 pilgrims. In was held in December, Dates not given. Between 15th February and 31st December there were 136 deaths from cholera in the district. In Chidambaram, town with 15,518 inhabitants, there were 27 cholera deaths between July 11th and 31st December, but there is no information to show the relation of these deaths to the 5,000 persons added to the population.

8. The main sanitary feature presented by these festivals is the addition of a certain number of persons to an already existing susceptible town population, living under the management of local boards, and, the problem presented by them is simply whether the usual municipal procedure could afford sufficient protection during cholera periods such as that which existed in the end of 1881. It is easy to see what might have been the result if, under such conditions, 50,000 people had entered these small towns instead of 5,000. The practical lesson appears to be that camping outside and away from the crowded town populations should be the rule, and that considerable increase of the conservancy staff and arrangements should be made.

9. As we have no means of comparing the cholera prevalence of 1882 with the experience of festivals during the same year, we shall simply give the general results for the 26 festivals held during this year. In some points these are interesting and instructive. The numbers present are not stated for three festivals. But for 23 the pilgrims present numbered 563,000. The whole 26 festivals escaped cholera with two exceptions, in one of which at Trivettore, in Chingleput district, there was cholera in the town a month before the festival began. In this state of matters 5,000 added people was not a favourable condition, and 15 of them died of cholera, but, as if to mark the danger of arriving at such a time, cholera ceased three days before the termination of the festival.

10. The other case was at the Kartigai festival, in South Arcot, where 25,000 people were assembled. In this instance, three deaths took place among incoming pilgrims, but the disease did not spread beyond these.

11. In three instances, where in all 67,000 pilgrims were assembled, cholera was in the vicinity of the places of pilgrimage, but no pilgrim suffered.

12. It thus appears that 24 festivals, attended by 488,000 pilgrims, escaped cholera altogether, and that the two attacked cases were accounted for by the circumstances at the time. In every case sanitary measures for protecting water, for cleansing, and providing latrines, appear to have been more or less successfully carried out, but as all such measures in the case of towns having local authorities should be in addition to the customary sanitary work, it would be very advisable that future reports should state more explicitly what were the sanitary precautions taken in each case.

2nd July 1883.

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REPORT

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TOGETHER WITH

MISCELLANEOUS INFORMATION UP TO JUNE 1883.

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1883.

BOMBAY BRANCH
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Royal Asiatic Society.
CLASS

REPORT

ON

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TOGETHER WITH

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REPORT.

BOMBAY BRANCH OF THE ROYAL ASIATIC SOCIETY

I.—EUROPEAN ARMY.

Sickness and mortality in 1882.

THE vital statistics of the European Army of India for 1882 show that the health of the troops generally was very favourable. Not only were the ratios of admissions to hospital and of daily sick considerably below those of preceding years, but the death-rate was the lowest on record. The average strength of the combined armies of the three Presidencies, according to the Report of the Sanitary Commissioner with the Government of India, was 57,269, or 1,459 less than in 1881. Among this body of men the admissions to hospital equalled 1,445 per 1,000 against 1,605 in 1881; the daily sick 65, or 5 per 1,000 less; and the mortality 12·07 against 16·86. There was a satisfactory reduction in the death-rates from all the more important diseases, except enteric fever, which was slightly more fatal than in 1881. "The nature of these reductions, the Army Sanitary "Commission observe, points to the effect of sanitary improvements at military stations, "and to generally improved management."

Of the three armies the health of those of Madras and Bombay were especially favourable, as is shown in the following table:—

Presidency.	Average Strength.	Ratio per 1,000 of Strength.		
		Admissions.	Daily Sick.	Deaths.
Bengal	35,164	1,579	69	13·17
Madras	11,020	1,058	57	10·25
Bombay	11,085	1,405	61	10·37
India	57,269	1,445	65	12·07

Considering each Presidency separately, the health of the Bengal army, although not so favourable as that of the armies of Madras or Bombay, was much more satisfactory than in 1881, when the admissions equalled 1,729 per 1,000, the daily sick 72, and the deaths 17·05,—a mortality nearly 4 per 1,000 in excess of the year under notice. As regards the army of Madras the differences in the ratios were not so great, the health of the troops in that Presidency having been very favourable in the previous year: still the admission-rate declined from 1,160 per 1,000 of strength-to-1,058, the daily sick from 60 to 57, and the death-rate from 10·97 to 10·25. Among the troops forming the Bombay army there was a considerable diminution of sickness with a marked reduction in mortality, the admission-rate having fallen from 1,784 per 1,000 in 1881 to 1,405, the daily sick from 72 to 61, and the death-rate from 13·44 to 10·37, which was the lowest rate on record, and nearly 5 per 1,000 below the average of the ten years 1870–79.

The chief causes of sickness in Bengal and Bombay were fevers, especially those of malarial origin, from which the admission-rates were 660 and 558 per 1,000 respectively; while in Madras the admissions under this head equalled only 171 per 1,000. In all three Presidencies enteric fever was the most fatal disease. The death-rate in Bengal from this fever was 2·90 per 1,000, in Madras 2·09, and in Bombay 1·90; from other fevers the death-rates were 0·77, 0·27, and 0·81 respectively.

As regards the six groups of stations into which the Bengal Presidency is divided, the highest death-rate was recorded in the Gangetic Provinces and Oudh group, namely, 22·61, over 7 per 1,000 greater than in 1881. More than a half of this mortality was due to cholera and enteric fever, the death-rates from which were 5·58 and 7·68 respectively as against 2·97 and 2·70 in the previous year. In all the other groups, excepting that of Agra and Central India, where the mortality in both years was almost the same, and under 11 per 1,000, there was a marked diminution in mortality, the most striking cases being Meerut and Rohilcund and the Punjab, the death-rate in the former having fallen from 17·31 to 8·86, and in the latter from 23·44 to 12·12. There was, however, a remarkable disproportion in the admission and death rates of the several groups; for while in the Meerut and Rohilcund group there was one fatal case to every 182 admissions, in the Gangetic Provinces one death occurred out of every 75 admissions, apparently showing that some cases of admission were of a much more severe character than others.

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Of individual stations in the three Presidencies, those of Delhi, Amritsar, and Meean Meer recorded admission-rates above 3,000 per 1,000, and in each of these fevers accounted for more than two-thirds. Eight other stations showed a ratio exceeding 2,000, namely, Fyzabad, Fatehgarh, Morar, Mooltan, Peshawar, Neemuch, Baroda, and Kurrachee. The highest mortality occurred in the Gangetic Provinces and Oudh group of stations, Sitapur coming first with 66·86 per 1,000 against 11·33 in 1881, Benares following with 40·10 against 31·40, Fyzabad with 38·75 against only 6·12, and Cawnpore 20·96 against 9·04. On the other hand, there was a considerable decrease in mortality in some of the Punjab stations, notably in Jullunder, Amritsar, and Meean Meer. The high death-rates at these stations in 1881 were ascribed mainly to the epidemic prevalence of cholera; but, excluding cholera altogether, the mortality in Jullunder from all other causes was only 1·25 per 1,000 against 34·58 in 1881; in Amritsar it was 4·05 against 29·66, and in Meean Meer 13·56 against 26·71.

More than a fourth of the European Army of the Bengal Presidency was located in the Hill stations, where the health of the troops was very favourable. The admissions equalled 975 per 1,000 of strength against 1,177 in 1881, and the death-rate fell from 9·97 to 8·65; and while in 1881 three stations recorded a mortality exceeding 10 per 1,000, only in one (Cherat with 11·22) was that ratio approached in 1882. It is further noticed that in 1882 five stations recorded death-rates of less than 5 per 1,000, whereas in 1881 only in two stations was the mortality as low.

In the stations comprising the Rajputana, Malwa, Sind, and Aden groups, the health of the troops continued favourable. Of an average strength of 5,172, the admission-rate fell from 1,995 per 1,000 to 1,745, but there was a slight increase in mortality from 11·90 to 12·37, which was chiefly due to cholera. Four of the principal stations had admission-rates exceeding 2,000 per 1,000 of strength, namely, Neemuch, Indore, Kurrachee, and Baroda, while in the largest station (Mhow) the admission-rate equalled 1,662 of an average strength of 1,350. Among the stations showing the highest mortality were Indore with a death-rate of 29·70, Nusseerabad 23·63, and Aden 20·49; the lowest were 4·24 in Deesa, 5·56 in Hyderabad, 5·89 in Kurrachee with Ghizree, and 6·67 in Mhow.

In the Deccan and Nagpore group of stations the results were most favourable. The admission-rate was only 1,029 per 1,000 of an average strength of 7,685 against 1,390 in 1881, and the death-rate fell from 12·52 to 7·94. None of the stations in this group recorded admission-rates reaching 2,000. The small station of Asirgarh, with an average strength of 122, recorded the highest death-rate, 24·59; Bombay coming next with 14·16.

The health of European troops in the stations of Southern India was also favourable. Of an average strength of 4,698 the admission-rate reached 1,119 per 1,000 against 1,236 in 1881; but, owing to a greater prevalence of enteric fever and heart disease, the death-rate rose from 7·74 to 8·30. Of the seven stations comprising this group, Bellary recorded the highest admission-rate, 1,327; Bangalore, which is the largest station, following with 1,166. The highest death-rates occurred at St. Thomas's Mount and at Bangalore, namely, 13·16 and 9·90 respectively.

In the four stations of Burma and Pegu there was also less sickness than in 1881, but a higher mortality, the admission-rate having declined from 1,122 to 1,047 of an average strength of 1,965, and the death-rate having risen from 10·09 to 11·20. The highest admission-rate in any of the stations occurred in Toungoo (1,194 per 1,000), and Rangoon (1,122 per 1,000). The latter station also showed the highest mortality, namely, 15·60, more than 5 per 1,000 in excess of the rate of the previous year; in Toungoo the death-rate was 9·22, against 4·44 in 1881.

Cholera.

Cholera did not prevail to any great extent among the European troops during the year, though it was epidemic over a great part of India, especially in the north; this fact speaks well for the precautionary measures adopted by the military authorities. There were only 98 admissions to hospital under this head; and of these 61, equal to 1·07 per 1,000 of strength, terminated fatally. In the previous year there were 199 cases, of which 137 or 2·33 per 1,000 were fatal. Of the 61 deaths, 45 or 1·28 per 1,000 of average strength, took place in the Bengal army; 9 or 0·82 in Madras; and 7 or 0·63 in Bombay. No less than 40 of the deaths in the Bengal army occurred in the Gangetic Provinces and Oudh group of stations, where the admission-rate from this disease was 8·5 per 1,000, and the death-rate 5·58. Exactly one half of the mortality occurred at the Fyzabad station; 8 deaths were also recorded at Lucknow, and 6 at Benares, all three stations belonging to this group. In the previous year the Punjab stations suffered

most, but during 1882 not a single case of cholera was noticed among the troops stationed there. The Hill stations and Convalescent depôts were also free of the disease. Of the 9 deaths which occurred in the Madras army, 5 took place among troops on the march; and of the 7 cholera deaths in Bombay 5 occurred at Nusseerabad.

Fevers.

On the whole, fevers of intermittent, remittent, and continued types were less prevalent among the European troops than in 1881. The admissions per 1,000 of strength fell from 669 to 546, all three Presidencies sharing in the diminution. From enteric fever there were 357 admissions to hospital, or 6·2 per 1,000 of strength. Of these, 146 died, equal to a death-rate of 2·55. In the previous year the admission-rate was 5·6 per 1,000, and the death-rate 2·64. In the Bengal army the admission-rate from this fever was 7·3 per 1,000, exactly 1 per 1,000 higher than in 1881, and the death-rate was 2·90 against 2·62. In Madras the admissions rose from 0·9 per 1,000 in 1881 to 4·0, and the mortality from 0·58 to 2·09. In Bombay also the admissions were in excess of the previous year, the rate being 5·1 per 1,000 against 4·2, but the death-rate fell from 2·83 to 1·90. The greatest number of cases in any one division occurred in the Gangetic Provinces and Oudh, which recorded an admission-rate of 16·9 per 1,000. Of the total 121 cases in this group, Sitapur station yielded 45 with 16 deaths, and Lucknow 29 with 13 deaths.

In regard to the relationship between enteric fever and age, the mortality among men under 25 years of age was 4·32 per 1,000 against 4·56 in 1881; from 25 to 29 years of age it was 1·55 against 1·57; and from 30 years and upwards 0·78 against 0·79. The influence of length of residence in India in relation to this disease is again shown by the fact that among men in their first and second years the mortality was 4·68 per 1,000 against 4·55 in 1881, while among those in their third to sixth year it was 1·93 against 2·07, and from the seventh to the tenth year 0·34 against 0·56.

Venereal diseases.

One of the chief sources of inefficiency among troops in India is venereal diseases. Under this head the admission-rate was again very high, namely 265 per 1,000—a higher ratio than had been recorded in any year since 1871, excepting 1878. The unfavourable results of 1882 were, however, due to the great prevalence of the diseases in Madras, where the admission-rate rose from 258 per 1,000 in 1881 to 288, for in Bengal and Bombay there was a slight diminution in the ratios as compared with those of the two previous years. From primary syphilis the admission-rate among the Bengal troops was 87 per 1,000, or 9 less than in 1881. In Bombay the ratio also declined from 81 to 68; while in Madras there was an increase of 21 per 1,000, the rate having risen from 89 in 1881 to 110 in 1882, which was the highest recorded in the Presidency since 1871, excepting that of 1879.

Invaliding.

The invaliding rate of the army of India as a whole was 33·08 per 1,000 of strength, which was lower than that of the preceding year by 5·28 per 1,000, and less also than the average of the ten years 1870-79 by 9·96. Of the total 1892 men invalided during 1882 more than half (985) were invalided for change and 694 or 37 per cent. for discharge, against 35 per cent. in 1881. Taking the three armies separately, the invaliding-rate in Bengal fell from 36·92 in 1881 to 34·96; in Madras, which yielded the smallest ratio, it declined from 27·91 to 24·12; while Bombay showed a great decrease, from 53·35 to 35·85. The special causes of invaliding in all three Presidencies were anæmia and general debility, diseases of the heart, hepatitis, and phthisis. Of the total number invalided, 31·82 per cent. were under 25 years of age, against 33·74 in 1881 and 35·84 in 1880, thus showing a gradual reduction in invaliding among young soldiers. There was, however, a slight increase in the ratio among men between 25 and 30 years of age from 34·58 to 35·31. As regards the influence of length of residence upon the invaliding of European troops, statistics show that during the last three years the proportion of men under two years' residence had greatly diminished, the ratio for 1882 being 17·35 per cent. of the total invalided, while among those of two to five years' residence the ratio was 57·30 per cent.

Another favourable feature in the health statistics of the European army is the improvement in the health of newly-arrived regiments in 1882. In 1881 the admissions to hospital of new regiments exceeded that of the army generally by over 200 per 1,000; but in 1882 the difference was only 23 per 1,000, namely, 1421·7 against 1444·8; and whilst in 1881 the death-rate was over 6½ per 1,000 higher, in 1882 it exceeded the general death-rate of the army by only 4·42. There was also a considerable decrease in the death-rate from enteric fever among newly-arrived troops, from 10·65 in 1881 to 7·18 in 1882.

II.—NATIVE ARMY.

Sickness and mortality in 1882.

The average strength of the Native army in India during 1882 was 114,894, an increase of 282 compared with the number of the previous year. The health of these troops was very satisfactory; for, both as regards sickness and mortality, the ratios were less than in 1881, and considerably below the mean of the quinquennium ending with that year. The admissions into hospital per 1,000 of strength were 1,129 against 1,305 in 1881, the daily sick 37, or 9 per 1,000 less, and the death-rate 12·24 against 19·24. Including deaths among men absent from their corps the death-rate was 14·76 per 1,000 against 22·62 in 1881. Malarial fevers, as usual, were the chief causes of sickness, and gave rise to just one half of the admissions, the ratio being 553·5 per 1,000 against 641·6 in the previous year. Respiratory diseases were the chief death causes, yielding a rate of 4·07 per 1,000, or about one third of the total mortality. From cholera there were 188 admissions, of which 117, or 62·23 per cent., were fatal. The death-rate from this disease was 1·02 per 1,000 of strength, against 0·97 in 1881, when the deaths numbered 111. In discussing the health statistics of the Native troops the Army Sanitary Commission notice the slightness of difference between the general death-rates of the European and of the Native Army (12·07 and 14·76), and also between the cholera death-rates (1·07 and 1·02). Both facts, they say, show that the "sanitary progress in "British regiments has overtaken that in Native corps in their own country."

The principal statistics of all branches of the Native Army in the three Presidencies were as follow:—

	Average Strength.	Ratio per 1,000.			
		Admissions.	Daily Sick.	Deaths from Cholera.	Deaths from all causes.
Bengal Native Army	40,256	1,250	41	0·72	13·34
Madras ditto	27,654	879	30	2·64	12·01
Bombay ditto	23,772	1,067	36	0·46	12·16
Central India and Rajputana Regiments	5,119	697	23	0·39	9·96
Punjab Frontier Field Force	10,605	1,992	60	—	15·94
Hyderabad Contingent	7,061	630	21	0·29	3·12
India	114,894	1,129	37	1·02	12·24

Bengal Native Army.

Among the troops composing the Bengal Native Army, which, as will be seen from the above table, comprised nearly a third of the total Native army of India, the results compare very favourably with those of the previous year. Not only was there less sickness, the admission-rate having declined from 1,495 per 1,000 of average strength in 1881 to 1,250, and the daily sick from 51 to 41 per 1,000, but the rate of mortality fell from 19·76 to 13·34. This satisfactory improvement manifested itself under all the chief diseases. The cholera death-rate fell from 0·92 to 0·72; respiratory diseases, which were the chief causes of mortality, from 6·59 to 4·50; fevers from 3·12 to 2·19; and dysentery and diarrhœa from 2·74 to 1·78.

Of the five geographical groups into which the cantonments of the Bengal command are divided, the Agra and Central India group recorded the lowest mortality, and the Bengal and Assam group the highest; but in all groups the results were favourable. The following table gives the chief statistics:—

	Ratio per 1,000.		
	Admissions.	Daily Sick.	Deaths.
Lower Bengal and Assam	1,569	54·7	18·22
Gangetic Provinces	1,081	39·1	10·01
Rohilcund and Meerut	1,083	43·2	9·98
Agra and Central India	1,248	38·5	7·18
Punjab	1,268	35·7	13·30

As stated above, the Bengal Native Army suffered but little from cholera during the year, and only two out of the five groups of stations were affected by the disease, namely, Bengal and Assam, which recorded a cholera death-rate of 3·01 per 1,000 and

the Gangetic Provinces, where the mortality under this head equalled 0·85. The mortality from fevers was also less than in 1881, all groups, excepting the Agra and Central India group, showing an improvement, while even in this group the increase was trifling, from 1·25 per 1,000 to 1·74. Respiratory diseases were mostly felt in the Punjab group, which yielded a death-rate of 5·94, less, however, by nearly one half than the ratio of the previous year.

The statistics of individual stations show that four stations recorded death-rates exceeding 20 per 1,000 of average strength; these were Alipore 31·25, Fyzabad 27·62, Mooltan 20·72, and Bhagalpur 20·18. At the first of these, 4 out of the total 31 deaths were due to cholera, and 13 to bowel complaints; at Mooltan 18 out of a total of 23 deaths were from respiratory diseases.

For the first three months of the year a small portion of the Bengal Native Army was on service in Afghanistan. In this force the mortality was very heavy, as is shown by the fact that out of an average strength of 748 there were 27 deaths, equal to 36·10 per 1,000, more than half of which was due to respiratory diseases.

In the Punjab Frontier Force there was more sickness than in 1881, but a diminution in mortality. The admission-rate (1,992) was 274 per 1,000 higher than that of the previous year, the daily sick-rate (60) 5 per 1,000 higher, while the death-rate fell from 17·95 to 15·94, a lower mortality than had been recorded since 1877. Of the total 169 deaths in this force 93, or 8·77 per 1,000 of strength, were from respiratory diseases, more than half having occurred at the two stations of Kohat and Edwardesabad and outposts.

The results in the Central India regiments were again favourable, both as regards sickness and mortality. The admission-rate declined from 815 per 1,000 to 697, the daily sick from 26 to 23, and the death-rate from 12·11 to 9·96. Respiratory diseases were the chief causes of mortality, yielding 18 deaths out of the total of 51. Guinea-worm was again very prevalent among these regiments; no less than 155 of the total 471 cases in the entire Native Army of India having occurred in this small force of 5,119 men.

The Hyderabad Contingent still held its place as being the most healthy of all the Native corps. During the year under notice it recorded an admission-rate of 630 per 1,000, or 43 less than in 1881, the daily sick-rate fell from 24 to 21, and the death-rate from 7·78 to 3·12. More deaths occurred from respiratory diseases in this force than from any other cause, the number being 9 out of a total mortality of 22. Guinea-worm was also the cause of many admissions to hospital in this force.

Madras Native Army.

With regard to the Native Army of Madras in 1882, of an average strength of 27,654 the admission-rate was 879 per 1,000, or 118 below the ratio of 1881; the daily sick-rate fell from 41 to 30 per 1,000; and the death-rate was 12·01, almost identical with that of the previous year. Over two-fifths of the admissions were caused by fevers, but of all diseases cholera yielded the greatest number of deaths, numbering 73, or 2·64 per 1,000 of strength, out of a total of 116 cases. Of these 73 deaths 45 took place in the month of March. Fewer deaths were recorded from dysentery and diarrhœa than in the previous year, 18 against 42; but from phthisis the deaths were double, 24 against 12.

Of individual stations in this Presidency the highest admission-rate was recorded at Bhowanipatna and Kalahundi, namely, 3,564 per 1,000 of an average strength of 711, for a period of only eight months, during which these troops were on active service, and greatly exposed to the vicissitudes of the trying climate. No less than 2,888 of this admission-rate were due to fevers. Of the larger stations, Berhampore had an admission-rate of 1,711, Hoshangabad 1,253, and Jubbulpore 1,064; while at Bangalore, which is the largest station, a rate of only 571 per 1,000 was recorded. In respect to mortality at individual stations, the highest was a five months' rate of 79·19 at Vellore, due to a severe outbreak of cholera, from which there were 48 deaths out of a total of 51 from all causes. The health of the troops stationed in Burma was more favourable than in 1881, but at the Andamans and Nicobars it was not so good.

Bombay Native Army.

The statistics of the Native Army of Bombay show that out of an average strength of 23,772 the admission-rate was 1,067 per 1,000, or 99 less than in 1881, the daily sick 36 against 41, and the death-rate 12·16 against 14·01. There was a marked exemption from cholera, only 18 cases having taken place with 11 deaths against 50 cases and 34 deaths in the previous year. A portion of the Bombay army (3,771 men) was on service in Southern Afghanistan, and the results among this force were most unfavourable, the

admission-rate having reached 2,146 per 1,000, nearly one half of which was due to fever. Respiratory diseases and dysentery were very prevalent, the former being the chief death cause, yielding 83 out of the 135 deaths from all causes, or 22·01 per 1,000 out of a total mortality of 35·80. The most favourable results of any single force in this army were in the case of that serving in Khandeish and Deccan, the admission-rate being 727 and the death-rate 6·26 per 1,000 of an average strength of 7,190. In Aden and Sind also the mortality was low, only 7·19 per 1,000. In the Northern Division it was also low—7·78. In respect to the mortality of individual stations, it is satisfactory to note, that while in 1881 three of the larger stations recorded death-rates exceeding 20 per 1,000, the highest mortality registered at any large station in 1882 was 14·29 at Nusseerabad.

Native troops in Egypt.

A small Native force, consisting of troops from each of the three Presidencies, was on service in Egypt for two months, from the middle of August till the middle of October. It enjoyed excellent health; the admission-rate was only 217·5 per 1,000 of an average strength of 2,566, the daily sick 26·5, and the death-rate 2·34. Only six deaths occurred, four having taken place in action, while one resulted from wounds received in action, and the other was due to dysentery.

III.—GENERAL POPULATION.

The following table gives the registered mortality in the different provinces of India from the four principal diseases and from all causes in 1882 :—

Provinces.	Cholera.		Smallpox.		Fevers.		Bowel Complaints.		Deaths from all Causes.		
	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000 in 1883.	Ratio per 1,000 in 1881.
Bengal, excluding Calcutta	182,352	2·75	13,651	0·20	920,943	14·06	61,362	0·92	1,349,651	20·41	18·99
Calcutta	2,249	5·10	12	0·03	3,618	8·20	1,454	3·30	13,277	30·09	36·00
Madras	23,604	0·81	20,159	0·69	183,561	6·54	19,058	0·68	470,700	16·29	16·20
Bombay	7,704	0·46	1,650	0·10	243,454	14·80	28,553	1·73	443,443	26·87	23·28
Punjab	39	—	6,379	0·34	346,680	18·40	15,960	0·85	504,799	26·79	20·72
North-Western Provinces and Oudh	83,372	2·09	26,628	0·66	1,093,414	24·90	93,661	2·12	1,465,127	33·62	31·79
Central Provinces	11,932	1·36	3,945	0·45	152,407	17·31	24,639	2·80	263,868	29·93	32·59
Berar	3,573	1·34	369	0·14	39,349	16·95	13,546	5·75	77,284	29·95	29·14
Assam	21,655	4·69	3,195	0·71	60,218	13·43	14,074	3·13	115,920	25·85	16·04
British Burma	7,127	1·96	770	0·21	27,093	7·59	3,291	0·90	59,146	16·15	15·75
Mysore	884	0·21	7,940	1·89	36,950	8·82	4,032	1·20	70,802	16·93	17·01
Coorg	31	0·17	465	2·61	2,306	12·93	140	0·78	3,112	17·45	17·90

Bengal.

Although considerable attention appears to have been given to the registration of vital statistics in Bengal during 1882, no progress was made in birth registration. Births were registered in 45 towns to the number of 37,198, or 22·49 per 1,000, a ratio which was made up of results varying from 8·54 per 1,000 in Darjeeling to 43·79 in Jamalpur. In the previous year births were registered in 46 towns, the number being 38,856, or 25·51 per 1,000.

The year on the whole was not a healthy one. The rainfall was below the average and irregular in distribution, still there was no deficiency in food; but prices were considerably higher than in 1881, though not so high as to be burdensome to the people. The number of deaths registered throughout the province was 1,349,651 or 20·41 per 1,000 of population against 1,255,478 or 18·99 in the previous year, showing an increase in the year under notice of 94,173, which was mainly due to cholera, the disease having prevailed with unprecedented severity during the year. To some extent, however, this increase was due to improved registration. The male death-rate was 22·50 per 1,000 and the female 18·37, while the proportion per cent. of male to female deaths was 120, the same as in the previous year. According to districts the mortality varied from 39·37 in Nuddea to 7·01 in Darjeeling.

The chief feature in the sanitary history of Bengal was the fatal prevalence of cholera. The deaths from this disease amounted to 182,352 or 2·75 per 1,000—a greater number than had been recorded in any year of the previous decade, except in 1876, and exceeding the mortality of 1881 by 103,163, or 1·54 per 1,000. As usual, the disease was diffused over the whole province, visiting every district and 13·52 per cent. of the total 201,989 villages. In the previous year only 8 per cent. of the villages were affected. Cholera was most prevalent in the Orissa division, especially in Pooree town, where, it is stated, the large influx of pilgrims swelled the nominal death-rate to 13·33 per 1,000. Notwithstanding that cholera was so unusually severe, there was a remarkable absence of the disease at most of the fairs, which, as the Sanitary Commissioner observes, speaks well for the care and attention bestowed in adopting sanitary precautions against its inroads. "Does this experience not prove anew," the Army Sanitary Commission ask, "that, under improved sanitary conditions at fairs, the villagers present at them are "safer from attacks of cholera than they would be at home, although in former times "fairs and their accompanying filth, bad water, and overcrowding, were the foci of local "epidemic outbreaks of cholera?"

From smallpox the mortality was considerably less than in either of the three preceding years. The number of deaths fell from 24,371 or 0·36 per 1,000 in 1881 to 13,651 or 0·20. All districts suffered, but only in four were the death-rates at all high,

namely, 1·06 in Chittagong, 1·02 in Poori and also in Cuttack, and 0·84 in Balasore. Of the total deaths 2,999 occurred among children under one year of age, and 6,130 among children between 1 and 12 years, together amounting to 9,129 or 66·87 per cent. of the total smallpox mortality. In the previous year a much larger proportion of children under 12 years of age suffered from the disease, viz., 72·04 per cent.

There were also fewer deaths registered under fevers than in 1881, the number having fallen from 940,911 or 14·23 per 1,000 to 929,943 or 14·06, a decrease of 10,968. "This reduction," the Sanitary Commissioner observes, "is unimportant, and "does not remove the belief, derived from a study of the general fever history of the "province, that, on the whole, fever was as prevalent and almost as fatal as it had been "in the preceding year, whose records figure by far the highest rate of mortality of any "year under registration." At the same time he points out that in estimating the death-rate of a year like 1882, immediately following one of exceptional mortality, some account must be taken of the many survivors of the previous year whose constitutions had been so shattered that they succumbed in the following year. The apparent increase under this head in the record of late years is considered to be probably due to improved registration, and not to any increase in mortality. Fevers pervaded 67 per cent. of the villages against 71 in 1881. They again manifested greatest virulence in Nuddea district, which recorded a fever death-rate of 30·18 per 1,000; in six other districts the mortality ranged from 28·86 to 21·61 per 1,000, and in 26 others it ranged from 19·72 to 10·52 per 1,000.

The mortality from bowel complaints was greater than in the previous year, the registered deaths having increased from 57,029 or 0·86 per 1,000 in 1881 to 61,362 or 0·92. These complaints were also slightly more widespread, for only 21 registering circles out of 644 escaped, while in 1881 they were absent from 24. The Sanitary Commissioner reminds us, however, "that the recorded figures do not approach even an "approximation to the actual prevalence and fatality of bowel complaints, so common "and frequent a cause of death in Bengal;" and he is of opinion "that it is under this "head that registration errors are chiefly to be found, for either a large number of cases "is omitted altogether, or the casualties are credited to cholera or fever."

In Calcutta the mortality of the year was unusually high, mainly owing to the great prevalence of cholera. The total deaths in 1882 numbered 13,177 or 30·4 per 1,000 against 13,030 or 30·0 in 1881. Of these 2,240 or 5·10 were credited to cholera against 1,693 in 1881. In the other chief diseases there was a sensible decrease of mortality, especially in smallpox, which caused only 17 deaths against 133 in the previous year; deaths from fever fell from 3,765 to 3,618, and those from bowel complaints from 1,491 to 1,454.

Madras.

The year 1882 in the Madras Presidency was comparatively healthy. The rainfall, excepting in the district of Ganjam, was much more propitious than in the previous year; food was abundant, and on the whole there was a steady tendency to a reduction in prices. The number of births registered during the year was 751,104 or 26·0 per 1,000 of population according to the census of 1871 (the census figures of 1881 not being available at the time of the preparation of the report), against 731,866 or 25·5 in 1881. The birth-rate of 1882 was the highest on record, and is looked upon as an indication of progress in registration. Deaths were more numerous than in the previous year by 5,018, the total number being 470,700 or 16·29 per 1,000, a ratio nearly the same as that of 1881. Little reliance can, however, be placed on either the birth or death rates, the former having been made up of extremes varying from 15·2 in Vizagapatam to 43·2 in Madras, and the latter of ratios ranging from 10·1 in Nellore to 34·8 in Madras. Infant mortality was very high, which the Sanitary Commissioner attributes to the cholera epidemic prevailing in districts, the disease having been more fatal to young children than to adults.

Cholera prevailed with much greater severity than in the two previous years. The deaths increased from 613 in 1880 and 9,446 in 1881 to 23,604 or 0·81 per 1,000 in 1882. The epidemic commenced in October of 1881, and continued into March of 1882, when it abated; but it began to prevail again in December. Out of the total 22 districts four escaped cholera, and two others, Kistna and Nellore, recorded only 10 and 2 deaths respectively. Tanjore district suffered more than any other, yielding over a third (8,811) of the total mortality under this head.

There was also a greater prevalence of smallpox and the mortality from it was higher than had been recorded in any year since 1878, the deaths numbering 20,159 or 0·65 per 1,000 against 15,776 or 0·55 in 1881. As usual, Ganjam district suffered most, yielding

a death-rate from this cause of 2·7 per 1,000, North Arcot, Cuddapah, and Coimbatore following with ratios of 1·1 per 1,000 each. In several municipalities the mortality from smallpox was very high, especially in Coimbatore, where it reached 10·7 per 1,000, the next highest being 6·1 at Trichinopoly, 5·7 at Anantapur, and 5·5 at Tellicherry. Among children the deaths were not quite so numerous as in the previous year, but were still in the proportion of 69 per cent. of the total, and nearly one-fourth of the mortality occurred among infants under one year of age.

Under fevers 188,561 deaths were registered, equal to 6·5 per 1,000, a less number than in 1881 by 14,981. Even with this diminution the number represents more than twice as many casualties as were registered under the four heads of cholera, smallpox, bowel complaints and injuries. The Sanitary Commissioner notices that during the last 14 years fever deaths have reached the appalling number of 3,269,522, whilst from cholera, which creates more fear and alarm, the deaths were less than a fourth, or 787,684, and from smallpox 464,124. The record of fever deaths in this Presidency, the Army Sanitary Commission remark, is a sorrowful one, "and affords an index to the kind of "improvements needed in local drainage of village sites, better dwellings, better water, "and improved tillage."

Deaths from bowel complaints rose from 18,961, or 0·60 per 1,000, in 1881 to 19,958, or 0·68, in 1882. These were recorded in all the 226 registration circles but six; in the previous year five circles were exempt.

In Madras City 14,169 deaths were registered, equal to 35·6 per 1,000 of population, against 15,487 or 38·9 in 1881. From cholera the deaths rose from 126 to 461; fever deaths numbered 3,706, or 8 more than in the previous year; and from bowel complaints there were 2,110 deaths or 185 more, while from smallpox the deaths fell from 1,654 in 1881 to 355.

Bombay

Progress continued to be made in the registration of vital statistics in the Bombay Presidency. The total number of births registered during 1882 was 491,346 or 29·86 per 1,000 of population against 459,657 or 27·93 in 1881. That there is still plenty of room for improvement is, however, shown by the great differences in the birth-rates of individual districts, which ranged from 16·51 in Upper Sind Frontier to 41·06 in Dharwar. In every district more male births were registered than female, the average excess being over eight per cent.; and in all districts but three, namely, Hyderabad, Shikarpur, and Bombay City, the registered births exceeded the deaths, the excess on the whole amounting to just 9 per 1,000, or nearly double that of the previous year. That the year 1882 was more healthy than 1881 is shown by the fact that the deaths were less by 38,032, the total number being 343,418 or 20·87 as against 23·18. This diminution was due chiefly to a reduced mortality in cholera, fever, and bowel complaints. By districts the death-rates ranged from 9·90 per 1,000 in Upper Sind Frontier to 26·16 in Bombay City. The proportion of registered deaths of females to males was 100 to 112·53.

Of the chief diseases cholera was considerably less fatal than in 1881, the deaths having fallen from 16,694 or 1·01 per 1,000 to 7,904 or 0·48. The districts of Kanara and Panch Mahals, and four out of the five districts of Sind-division, were entirely free from the disease, and only in the districts of Satara and Belgaum in the Southern Deccan division was cholera at all virulent, these recording death-rates of 2·26 and 1·54 respectively. In most of the districts in which the disease prevailed the outbreak was attributed to defective sanitation, especially bad drainage. In some of the towns, however, the mortality was very high, notably in Gokak in Belgaum, which recorded a cholera death-rate of 15·81, and Kapadvanj in Kaira, 9·62. With a view to remedy this state of things the Government of Bombay have directed the attention of district officers and city municipalities to the revised Suggestions of the Army Sanitary Commissioners for the improvement of towns and villages, which have been circulated throughout the Presidency. Cholera deaths were recorded in 125 of the total 286 registration circles, but only 804 out of 24,431 villages were affected.

The deaths registered from smallpox were 1,630 or 0·10 per 1,000, being 1,091 in excess of the number of the previous year. Of the 24 districts Broach and Upper Sind Frontier were entirely free from the disease, and of the remainder Poona comes first with a maximum mortality of 506 deaths, Thana following with 328, and Khandeish with 131. In six other districts the deaths were above 50 and below 100, and in five the mortality was above 10 and below 50. Of the total deaths 874, or a little more than one half, occurred among children under 12 years of age.

Fever deaths were less than in 1881 by 28,949, the total number being 243,454 or 14·80 per 1,000 against 272,403 or 16·56. In every division the mortality was less,

excepting in Sind, where the deaths rose from 27,575 to 37,785. The highest district fever death-rate was 19·66 in Shikarpur, and the lowest 7·01 in Bombay City. The Acting Deputy Sanitary Commissioner, Sind Registration Districts, says: "The greatly "increased number of deaths in the Shikarpur district from fever is, I think, due to "the inundations, and, as is usual, the greatest number was registered in November. "That this month is peculiarly unhealthy in the Shikarpur and Jacobabad divisions is "clearly shown, whilst the colder months, December to March, are most fatal in the "three remaining districts."

During the year 23,353 deaths were registered under bowel complaints, equal to 1·72 per 1,000 of population, against 30,342 or 1·84 in 1881. By divisions deaths under this head were most numerous in Southern Deccan, and fewest in Sind; while by districts the largest number (4,206) was recorded in Khandesh in Northern Deccan, and the lowest (8) in Thar and Parker. The highest death rate was 3·98 in Dharwar.

The health of the capital during 1882 was favourable. Exclusive of still-borns, 20,468 deaths were registered, a less number than in 1881 by 1,388. The death-rate per 1,000 of population was 25·89, against 27·65. Of the total deaths 192 were due to cholera, against 546 in 1881; 92 were occasioned by smallpox against 35; and from fevers 5,453 deaths were registered against 6,437. The mortality from bowel complaints was also less, but, on the other hand, there was a greater mortality from measles, phthisis, and diseases of the nervous system.

Punjab.

The vital statistics of the Punjab for 1882 show that 690,524 births were registered during that year, the ratio per 1,000 of population being 36·65 against 695,766 or 39·79 in 1881. To some extent the difference in the ratios (namely 3·14) is due to the birth-rate for 1881 having been calculated on the census figures of 1868, whereas the results of the recent census, on which the ratio for 1882 is based, show that the population had increased by about 7 per cent. The male births largely exceeded the female births, the mean proportion being 116 to 100. In no district was it less than 108, while in some of the frontier districts the excess was more marked, particularly in Peshawar, where 168 male births were registered to every 100 females. It is reported that in the frontier districts registration of births and deaths is more imperfect than elsewhere, and that the people are unwilling to report the births of females. By districts the birth-rates ranged from 11·20 in the hill station of Simla and 18·91 in Peshawar to 44·73 in Sialkot.

The province was remarkably free from epidemic disease during 1882, and the general health of the people was fairly satisfactory. The registered deaths declined from 519,779 or 29·72 in 1881 to 504,799 or 26·79, nearly one-half of which (47 per cent.) occurred among children under five years of age. In several districts the mortality was much above the mean of the province, especially in Jhang, Mooltan, Shahpur, and Muzaffargarh, which recorded death-rates ranging from 33 to 45 per 1,000. Apparently the rural districts are far in advance of the towns as regards healthiness, the mean death-rate in the former being 26 per 1,000 against 33 in the latter.

Only 39 deaths were registered from cholera against 5,207 in 1881. In his Report the Sanitary Commissioner gives a chart showing the rise and fall of the disease since 1867. During this period of 16 years 106,608 cholera deaths had been registered in this province, the number varying greatly in different years. "One result," the Army Sanitary Commission remark, "follows from the facts, namely, that up to the present "time we have no means of accounting for them. No theory of cholera germs, cholera "poison, personal contact, commercial intercourse, railways, insanitary surroundings, "bad water, or climate peculiarities, throw the smallest light upon the facts. The "intensity and fatality of the disease in each year is governed by some other factor, and "it is mere waste of time and effort to try to explain them on any series of suppositions, "however plausible these may appear to be, while it is positively injurious to the best "interests of the public health to assume that because some one thinks he has observed "a distinct case of causation, therefore this case can be usefully made to include all "other cases, whether a cause was or was not observed." In the first eight years of this period the deaths numbered 62,727, and in the latter eight 43,881, "showing "apparently the influence of sanitary work on the mortality."

From smallpox the registered deaths numbered 6,379 or 0·34 per 1,000, being less by 370 than the mortality of 1881, and lower than in any year since 1868. Nearly two-thirds of the deaths occurred in six frontier districts where vaccination had been neglected. Statistics show, as noticed by the Army Sanitary Commission, that epidemic smallpox is a much more fatal disease in the Punjab than cholera, for during the last 15 years ending 1882 there were 339,281 deaths from small-pox, or in the proportion of

upwards of five deaths to every cholera death. Still it is satisfactory to learn that during the latter half of these 15 years the mortality was less by 56,521 than in the first half.

The mortality from fevers was again heavy, though the number of deaths declined from 355,279 or 20·32 per 1,000 in 1881 to 346,680 or 18·40. Cholera and smallpox are small matters compared with fevers. This is pretty evident from the fact that 68 per cent. of the total deaths in the province were registered under fevers. Deaths were recorded in all the districts, and in over 82 per cent. of the 34,973 centres of population. There was, however, a great difference in the distribution of fever mortality as compared with the previous year, for while in 1881 the districts lying east of the Chenab suffered most, in 1882 the districts west of that river, and more especially those lying along the banks of the Jhelum and Indus, recorded the highest mortality. The fever was generally of a malarious type, and the exceptional mortality in these districts was attributed partly to floods and to excessive rainfall. The Sanitary Commissioner considers that much of the sickness and mortality arising from malarious fever is to a great extent preventable, being produced by neglect of effective drainage, and want of precaution in matters of habitation, clothing, and food. The Government of India has called the attention of the Local Government to Dr. Bellew's suggestions; and, except in the matter of clothing, which it is impossible to undertake, they consider that official steps might be taken to give effect to them.

Deaths from bowel complaints were considerably below the average of former years, and fell from 17,281 or 0·99 per 1,000 in 1881 to 15,960 or 0·85.

North-Western Provinces and Oudh.

The vital statistics of the North-Western Provinces and Oudh show a falling-off in the number of registered births, from 1,779,473 or 40·34 per 1,000 in 1881 to 1,656,159 or 37·54 in 1882. Still the fact that the average ratio of the municipalities (37·75) was almost identical with the general rate of the provinces points to progress in registration. By districts the birth-rates ranged from 22·42 in Dehra Dun to 53·03 per 1,000 in Lalitpur, a diversity showing that there is still much room for further improvement.

The mortality returns also furnish evidence of some progress in registration. The deaths rose from 1,402,473 or 31·79 per 1,000 in 1881 to 1,485,127 or 33·67,—a ratio which, the Sanitary Commissioner observes, does not admit of question, as the names of all these persons were recorded in the registers. Kumaon, Dehra Dun, and Garhwal districts recorded the lowest death-rates, viz., 20·56, 21·46, and 22·89 respectively, while in Bareilly it was 52·10 and in Tarai 59·63. Of the two latter ratios 36·15 and 47·79 were due to fevers. The Sanitary Commissioner is unable to account for these differences, except that in the case of Kumaon and Garhwal a considerable portion of the people during the cold season migrate to the plains, thus relieving the Hill tracts of deaths occurring among their population, and adding to the mortality of the Terai. In all probability, therefore, these great differences are more apparent than real.

There were also great differences in the town death-rates. The highest was 97·39 in Ajudhia, followed by 73·41 per 1,000 at Sambhal in the Moradabad district, 70·94 of the former ratio and 35·04 of the latter being due to fevers. The Army Sanitary Commission notice that the mortality from cholera in Sambhal was only 0·33 per 1,000, and that for every cholera death there were 107 fever deaths. "It would appear on "the simple facts of the case," they say, "that it should be dealt with at once, for surely "no instance of greater need of improvement could be cited, and there are few cases in "which the results would be more satisfactory, if the necessary works were intelligently "framed and skilfully carried out."

Of the chief diseases cholera was more prevalent than in any of the preceding 12 years. The deaths numbered 89,372 or 2·02 per 1,000 against 25,865 or 0·58 in 1881, and exceeding the previous five years' average by 1·18 per 1,000. The disease commenced to prevail early in the year. It first appeared in January at Allahabad at the time of the great Khumbh or twelfth-year fair. In March it appeared in other eastern districts, and continued to prevail until August, when it declined, and broke out with great virulence in some of the western districts north of the Ganges. The three districts of Sitapur, Kheri, and Pilibhit suffered most severely, their mean death-rate from this cause being 9·0 per 1,000,—Pilibhit recording the highest ratio, namely, 12·66 per 1,000. The Sanitary Commissioner, in his Report for the year, gives a list of the mortuary circles and towns and villages in the province which recorded the greatest cholera mortality, and states that a comparison with lists of former years shows that some of the places are becoming noted as places of cholera epidemic prevalence. The places are not as yet numerous, but he has little doubt that as years pass "they will increase in number, to the

" ultimate determination of the places in each district where sanitary improvement is most " desirable." The Sanitary Commissioner and Deputy Sanitary Commissioners have been directed personally to inspect, as far as possible, the localities in question during their winter tours, with the view of ascertaining if any special reasons in their sanitary condition exist for the annual recurrence of cholera.

Notwithstanding the prevalence of cholera in the province, the Allahabad fair of 1883, which commenced on the 10th January and lasted to the 10th February, was free from the disease. The average attendance at this fair, however, did not exceed 100,000, whereas at the fair of 1882, which was the great twelfth-year's fair or Magh Mela, the average daily attendance was about a million. Everything was done for the sanitary welfare of the people, and the fair resulted in being a great success from a sanitary point of view. There was very little disease of any kind; and "certainly," it is stated, "no case of disease like cholera occurred from the beginning to the end of the assembly;"—"another " example," the Army Sanitary Commission remark, "of the application of sanitary " principles and freedom from epidemic disease."

Smallpox also was more prevalent than in the previous year, the deaths having increased from 17,153 or 0·39 per 1,000 to 26,628 or 0·60. Although the disease spread itself all over the provinces, except in the district of Dehra Dun, the entire mortality took place in 8,403 villages out of a total of 105,421. Smallpox was more severely felt in Lalitpur than in any other district, visiting all but ten of its 670 villages, the death-rate being 5·94 per 1,000.

Over 70 per cent. of the total mortality of the provinces was assigned to fevers, the deaths numbering 1,098,414 or 24·90 per 1,000, a less number than that of the previous year by 2,185. As usual, the Tarai headed the list of district death-rates with 47·79, Bareilly following with 36·15, and Fatehpur with 31·56. The Sanitary Commissioner again notices the continued high fever death-rates in certain canal-irrigated districts:— "There cannot be a doubt," he says, "that extensive irrigation operations do tend to " increase fever prevalence and mortality, and that such result must be accepted as one " of its unavoidable attendants. The medical history of Northern Italy witnesses to " the truth of this; and there, I believe, the actual irrigation of land neighbouring the " habited site is forbidden. No such rule is enforced in this province, and nothing is " more common than the persistent irrigation of land touching the walls of habitations. " As a result, many habitations may be found with dampness permeating the walls up to " the tiles or thatch which form the roof." It is satisfactory, however, to learn that of late years there has been a considerable diminution of mortality in some of the canal-irrigated districts, and that the mean death-rate from fevers in the country of canal-irrigation only exceeded the provincial rate by 1·4 per 1,000. "It seems clear," the Lieutenant Governor observes, "that other causes besides canal irrigation contribute towards bringing about " fever epidemics, and the existence of cyclical periods of excessive fever prevalence " should be carefully investigated in the light of the statistics accumulated each year." In commenting on this matter the Army Sanitary Commission observe that the point for consideration is whether the occasional loss of life from scarcity of food would be less without irrigation and abnormal rainfall in a series of fairly plentiful years. And they think that the condition of the dwellings furnishes the reply, for no population living under such conditions can escape great loss year after year from fevers.

From bowel complaints 93,661 deaths were registered, equal to 2·12 per 1,000 of population, against 82,814 or 1·88 in 1881. The Sanitary Commissioner thinks that dysentery was the chief among the bowel complaints, and the fact that the majority of the deaths were registered in the autumn months points, in his opinion, to their being of malarious origin.

Central Provinces.

In the Central Provinces the birth-rate fell from 48·94 per 1,000 of population in 1881 to 41·73 in 1882. Any comparison of ratios, however, is of little value, as that of 1882 has been calculated on the census population of 1881, which showed that since the taking of the previous census in 1872 the population under registration had increased from 7,409,865 to 8,802,040 or about 16 per cent. The total number of births registered during 1882 was 367,328 against 362,744 in 1881. The district birth-rates varied from 33·93 in Burhanpur to 48·41 in Saugor. In every district the male births exceeded the female births, the average excess being nearly 8 per cent., and in all districts more births were registered than deaths, the provincial excess being 11·75 per 1,000.

The year's returns show a much heavier mortality than occurred in 1881, the registered deaths having risen from 241,467 or 32·59 per 1,000 to 263,868 or 29·98. This increase of 22,401 deaths was not due to any special cause, but was distributed

under all the ordinary diseases; some portion, it is thought, was also due to improved registration. The year, however, does not appear to have been a healthy one; the rainfall was exceptionally heavy, and the alternations of temperature exceptional, but withal food was abundant and cheap. The district death-rates varied from 23·34 in Burhanpur to 43·34 in Narsinghpur.

Cholera was more prevalent than in either of the two preceding years, the deaths numbering 11,932 (or 1·36 per 1,000) against 9,140 in 1881 and 330 in 1880. All the districts were affected but two, Burhanpur and Betul, but the entire mortality took place in less than six per cent. of the 27,529 villages. The greatest number of deaths occurred in Bilaspur district, namely, 2,285, Seoni following with 1,976.

Smallpox was also much more fatal. The deaths rose from 1,816 in the previous year to 3,945 or 0·45 per 1,000 in 1882. The disease visited all the districts but Chanda, the principal sufferers being Seoni, Jubbulpore, and Saugor, which together yielded more than half the total mortality. All the deaths but 594 occurred among children under 12 years of age.

The mortality from fevers was very heavy, the deaths numbering 152,407 or 17·31 per 1,000, which was 8,474 in excess of the number of 1881. In the registration forms, the Sanitary Commissioner points out, all fevers are entered under one heading, "but there "can be no doubt," he says, "that many other diseases are included under the heading "of fever. Unfortunately these diseases could only be distinguished by a medical man. "In India by fever is generally understood malarial fever or ague, and there can be no "doubt that this is the most common of Indian diseases, and the one which carries off "the greatest number of people."

There were 24,639 deaths or 2·80 per 1,000 of population registered under bowel complaints, an increase of 2,506 over the number of 1881. Sambalpur district recorded the highest mortality (12·38), and Bhandara the lowest (0·40).

Registration of births and deaths in Berar during 1882 was attended with satisfactory results. There is still, however, considerable room for improvement, especially in the registration of births in towns. Greater accuracy and reliability are expected from the new system of maintaining the registers and tabulating the results, which was inaugurated at the beginning of 1883. The number of births registered during 1882 was 110,454, or 42 per 1,000 of population, against 104,921 or 39·9 in 1881. There was little variation in the district ratios, while in every district the male births were more numerous than the female births, the average excess being nearly 6 per cent. It is further noticed that in each district the birth-rates were higher than the death-rates. The total number of registered deaths was 77,214, or 29·35 per 1,000 against 76,661 or 29·14 in 1881. It will thus be seen that the deaths were less than the births by 1¼ per cent. The town and district death-rates varied but slightly, being 29·7 and 29·3 per 1,000 respectively. Berar.

The mortality from cholera was much the same as in 1881, namely, 3,573 or 1·34 per 1,000 against 3,404 or 1·29. Fourteen of the deaths occurred in January. The province was then free until the 20th July, when a case occurred in a village in Wun district, situated in the extreme east of the province; the day following another case took place in Buldana district, in the extreme west; and shortly after cholera appeared in the other four districts. Although all districts suffered, the disease was confined to specific localities, for the whole of the deaths were registered in 481 centres of population out of 5,238. The first case which occurred in the Wun district was that of a woman who had been to Nagpore, in the Central Provinces, and returned on the 19th July (her husband having brought her back by forced marches a distance of 70 miles), dying the next day. The villagers attributed the outbreak to importation, though there does not appear to be any evidence that cholera was prevailing at Nagpore at the time of the woman's visit. As an example of how cholera was kept from extending by "timely application of simple sanitary proceedings," the Army Sanitary Commission instance the case of the Deulgaon Raja fair in Buldana. On account of the prevalence of cholera in that district the Government discouraged the holding of the fair, which generally lasts about three weeks, and is attended by from 80,000 to 150,000 persons. But in spite of warnings, the people gathered in greater numbers than usual. Sanitary precautions however had been taken, and the result was that only two cases of cholera occurred, one of which proved fatal, while the health of the people was "good throughout."

From smallpox there were 369 deaths against 225 in 1881. Each district was affected; but all the deaths occurred in 95 of the 5,238 villages. The disease was principally felt in Akola, which alone yielded 181 of the total fatal cases.

Fever deaths were registered to the number of 39,340 or 14·95 per 1,000 against 41,681 or 15·84 in 1881, showing a decrease in 1882 of 2,341. The Army Sanitary Commission notice the great differences in fever death-rates in the several districts, which ranged from 10 per 1,000 in Buldana to 21·3 in Wun, against a previous five years' average of 11·7 and 20·1 respectively. Similar differences occurred among the towns. "There must," the Commission remark, "be reasons climatic, topographical, and local, "for the differences, and we would suggest, by way of trial, an exhaustive local exami- "nation, engineering as well as sanitary, into the causes." The Sanitary Commissioner, in his Report, gives a table showing the seasonal incidence of fevers in relation to climate. "This shows," he says, "that our Indian fevers are most prevalent after the "heavy rains have water-logged the subsoil . . . . . for which the remedy is "drainage. In some of our larger towns drainage schemes are in progress, and will be "urged on to completion. In our smaller towns and villages, however, but little has "yet been done in this direction. For villages, a deep cutting to answer as a drainage "channel where water is likely to lodge is what has been recommended; and though "the people could do this themselves, still it requires to be done under direction."

Deaths registered under bowel complaints numbered 13,546 or 5·15 per 1,000, the mean ratio of the previous five years being the same. As with fevers, there were striking differences in the death-rates of individual districts, varying from 0·6 per 1,000 in Wun to 8·3 in Akola, the mean mortality of the latter district for the previous five years being 9 per 1,000.

Assam.

Great progress was made in the registration of vital statistics in Assam during 1882. In 1880 registration of births was confined to eight towns; in 1881 it was extended to six districts of the province; and in 1882 it was further extended to the two Plain districts of Sylhet and Cachar, and to two selected areas in the Khasi and Jantia and Garo hills, so that, except in the Hill districts, birth registration has now been introduced throughout the province. "The system now in force," the Sanitary Commissioner states, "and as yet in its infancy, will in a year or two carry the work of registration "home to the people themselves, who will become accustomed to the process, and more "ready to give information to the agents of registration." In accordance with a recommendation of the Army Sanitary Commission a beginning was also made in the tea-gardens in the registration of births and deaths. Registration of births, however, in the districts of Sylhet and Cachar, and in the selected Hill areas, was not commenced until the middle of the year: the comparison of the results in 1881 and 1882 is therefore restricted to the six districts of the Brahmaputra valley. In these the births rose from 42,733 or 19·20 per 1,000 of population in 1881 to 58,626, or 26·34 in 1882.

The deaths registered in the eight plain districts increased from 71,941 or 16·04 per 1,000 in 1881 to 115,920 or 25·85, the increase being due chiefly to improvement in registration. According to sex 106·19 male births were registered to every 100 females, while the number of male deaths to every 100 females was 113·70,—a proof that there is still much room for improvement in registration, for if these ratios were correct there would be a gradual decrease of males.

The year was marked by a very heavy mortality from cholera. There were 21,055 deaths or 4·69 per 1,000 registered, against 5,010 or 1·12 in 1881. Every district and every town was affected, but in the districts of Kamrup and Nowgong the disease was intensely severe, the death-rates reaching 12·24 and 7·22 respectively. More than a third (7,896 deaths) of the total cholera mortality of the year took place in the Kamrup district. The epidemic was felt in 3,082 villages out of 18,701, and deaths were returned from 314 out of 686 circles of registration, "affording," the Army Sanitary Commission observe, "a striking confirmation of a law of cholera diffusion, to "which we long ago called attention, namely, that the intensity of an epidemic is repre- "sented not only by the number of deaths in each locality, but by the number of "localities attacked." The Sanitary Commissioner says: "Cholera appears to be ever "present, either in a sporadic or active form, in the districts of Assam. The valley of "the Brahmaputra and the valley of the Surma are alike endemic areas; and there is "no evidence to show that any district is ever entirely free from the disease. On the "contrary, the mortal statistics of the province plainly, as I read them, tell us of its "perpetual and almost universal presence." Cholera was also felt very severely on board the river steamers. In the previous year there were only two fatal cases among 8,213 immigrant coolies, whereas in 1882 there were 63 deaths from cholera out of 12,636 coolies who started from Dhubri to Dibrugarh, a journey of 12 or 14 days. Careful investigations, it is stated, were made into the outbreaks, but nothing was elicited to explain them. Dhubri itself was unusually free from cholera during the year, but the disease was

present in active virulence in the districts through which the vessels passed. The Army Sanitary Commission repeat their recommendation that these river voyages should be arranged as far as practicable so as to avoid the cholera months. "Altogether," the Chief Commissioner states, "it cannot be said that the observations of the year con- "tributed much towards the ætiology of this most obscure and terrible of the diseases "of India."

Smallpox presented no abnormal features during the year. The deaths numbered 3,195 or 0·71 per 1,000, being 66 in excess of the mortality of the previous year. Of these 613 occurred among children under one year of age, and 1,350 among those under 10 years. Although the disease was generally diffused over the province its attacks were local, as is shown by the fact that only 7 per cent. of the total 18,701 villages were affected. Darrang and Sibsagar were the only districts in which the mortality was high, and these recorded death-rates of 2·71 and 1·64 per 1,000 respectively.

Under fevers, 60,218 deaths or 13·43 per 1,000 of population were registered, against 42,553 or 9·49 in 1881. Statistics show that the greatest mortality from fever in Assam occurs during the last three months of the year, and at the commencement of the rains in June and July. "The causes of malarial fever," the Sanitary Commissioner states, "are ever present. Dense jungles, decomposing vegetation, a water-logged "soil, obstructed drainage, areas in many districts for months under water, poor habita- "tions, are among some of the conditions under which the people live, and therefore we "may always look for a high mortality from malarial causes." In the Garo hills a specific fever or malarial poisoning, known among the natives as *kala-azar*, or black sickness, from the colour which the skin assumes in chronic cases, prevailed to a very great extent, especially among the tribes occupying the low hill tracts which lie between the hills and the plains. There is no general registration of deaths in the Garo hills, but it is known that large tracts are being depopulated by this fever. The natives believe it to be contagious, and so great is their horror of its appearance amongst them that they frequently separate those affected from the other members of the family or community. There appears, however, to be no ground for admitting that the disease is infectious. "More *post mortem* evidence," the Chief Commissioner states, "and closer observation "of its development in subjects affected, are necessary before anything can be definitely "proposed as to its treatment."

The mortality from bowel complaints continued to increase in the province, which is doubtless due to improvement in registration. The deaths numbered 14,074 or 3·13 per 1,000, being 4,289 in excess of the number recorded in 1881, and nearly double that of 1880.

Little progress was made in the registration of vital statistics in British Burma during 1882. The registered births rose from 73,754 or 19·98 per 1,000 of population in 1881 to 80,848 or 22·07, and the deaths from 58,136 or 15·75 to 59,146 or 16·14; but both the birth and death rates, it is stated, would be nearer the truth if they were doubled. British Burma.

Of the chief diseases of the year the mortality from cholera was greater than in any of the previous ten years, excepting 1873 and 1877. The deaths from this disease in 1882 numbered 7,177 or 1·96 per 1,000 against a ratio of 1·42 in 1881, and 1·52 the mean of the five years 1877-81. Every district suffered, but only 232 villages out of 14,942 returned deaths. The disease assumed an epidemic form in the districts of Prome, Tavoy, Thonegwa, Bassein, and Akyab, and in the towns of Prome, Tavoy, and Pantanaw. The Army Sanitary Commission instance the case of Akyab town, where 43 cholera deaths occurred during the year, as showing the relation of local causes to cholera prevalence. Several of the houses in the town where the disease first appeared were visited by the medical officer, who, finding the locality in a filthy condition, recommended the introduction of a gang of conservancy coolies to cleanse the drains, and remove filth and rubbish; he also recommended the closing of the wells, the water from which was of doubtful purity. The effect of these measures was that the epidemic gradually died out. The Commission urge the importance of precautionary measures being taken before the appearance of disease.

Fewer deaths were registered from smallpox than in any year since 1875; and only in two districts, Akyab and Toungoo, did the disease prevail in an epidemic form. Out of a total of 770 deaths these two districts contributed 674, the former yielding 391 and the latter 283. In Toungoo the epidemic was attributed to the prevalence of inoculation, and in Akyab to a want of vaccinators in the rainy season.

The number of deaths ascribed to fevers was 27,093 or 7·39 per 1,000 against 27,743 or 7·51 in 1881. Although deaths were recorded in all the districts, less than a tenth of the 14,942 centres of population appear to have been affected by fever. The statistics under this head, however, are of little value; for it is certain, it is stated, that a number of deaths classed as resulting from fevers should rightly be ascribed to other causes. "As in the previous year," the Sanitary Commissioner states, "July, August, "and September is the quarter which returns the greatest mortality. At that season "the whole country, especially the delta, is water-logged, water in wells rises to within "a foot or two of the surface, atmospheric humidity is then most pronounced, mean "maximum temperature at its lowest, and mean minimum about its highest, with "consequently the smallest mean temperature range."

The registered deaths from bowel complaints fell from 3,808 or 1·03 per 1,000 to 3,291 or 0·90. Although deaths under this head were registered in every district of the province, only one village in every hundred appears to have suffered.

Coorg.

Owing to the unusually heavy rains the health statistics of the province of Coorg during 1882 were not satisfactory. The number of births registered was 2,798 or 15·69 per 1,000 against 15·86 in 1881. The registered deaths were 3,112 or 17·45 per 1,000 against 3,192 or 17·90 in 1881. It will thus be seen that the deaths exceeded the births by 1·76 per 1,000 of population. The proportion of males born to every 100 females was 108·18, and that of male deaths to every 100 females was 125·83. This excess of male deaths over females is reported to be due to the excess of male population consequent on the immigration of men from Mysore in quest of employment on coffee estates, and not to higher mortality among men. There were only 31 deaths from cholera, while over two-thirds of the total mortality or 74·1 per cent. were due to fevers, and 14·8 per cent. to smallpox. Deaths from bowel complaints rose from 122 in 1881 to 140, the increase being attributed to excessive dampness and cold.

IV.—JAILS.

Since 1878, the year following the last famine, there has been a steady decrease in the jail population of India. In that year the average strength of the jails, according to the Report of the Sanitary Commissioner with the Government of India, was 127,914, but in 1882 it had fallen to 94,063. With this reduction in strength there has been a progressive improvement in the health of the prisoners as a whole; but in several jails the range of sickness and mortality still continues very high. The rate of admissions into hospital per 1,000 of strength in 1882 was identical with that of the previous year, namely 1,214; the daily sick-rate was 3 per 1,000 less, 42 against 45; and the death-rate fell from 44·03 to 39·96. The high rate of admissions is accounted for by the greater number of trivial cases treated, consequent upon the increased attention bestowed on the health of the prisoners generally. Sickness and mortality in 1882.

The following statement shows the sickness and mortality among prisoners in the various provinces of India during 1881 and 1882:—

Provinces, &c.	1882. Ratio per 1,000 of Average Strength.			1881. Ratio per 1,000 of Average Strength.		
	Admissions.	Daily Sick.	Deaths.	Admissions.	Daily Sick.	Deaths.
Bengal	1,642	54	69·21	1,594	53	67·13
Madras	795	29	42·62	737	28	41·91
Bombay	843	26	33·35	1,076	34	41·88
Punjab	1,546	45	41·63	1,519	48	65·15
North-Western Provinces and Oudh	724	29	22·93	764	32	23·78
Central Provinces	966	41	71·05	790	29	29·30
Berar	449	12	8·50	825	24	16·51
Assam	1,735	45	38·08	1,305	42	39·02
British Burma	1,168	39	27·82	883	36	45·82

Notwithstanding the efforts that have been made to raise the general sanitary condition of the jail population of Bengal, there was no improvement in the health of the prisoners in the year under review. It will be seen from the above table that there was a slight increase in the daily sick-rate, and that the mortality was over 2 per 1,000 higher than in 1881. The rise in the admission-rate from 1,594 to 1,642 the Inspector-General attributes partly to the increased care taken in sending to hospital all prisoners who showed symptoms of even a slight deterioration of health. The increase in mortality was due to the general unhealthiness of the country, but chiefly to the prevalence of cholera. Bengal.

Amongst convicts in jails and subsidiary jails the admissions to hospital equalled 1,741 per 1,000 of average strength against 1,696 in 1881, the daily sick-rate 55 against 54; and the death-rate 69·8 against 68·6. Excluding deaths from cholera the convict death-rate in jails only shows a progressive decrease since 1879. In that year the death-rate was 79·6 per 1,000, in 1880 it fell to 63·6, in 1881 to 63·4, and in 1882 to 60·3. The range of sickness and mortality was very great in the different jails. In Moorshedabad the admission-rate was as high as 3,341 per 1,000, and only 281 at Balasore; and while at Pubna the death-rate was but 11·1, at Mymensingh it reached 272 per 1,000. Of the 46 jails in the province, the mortality in 12 exceeded 10 per cent. of the average daily strength, in 17 it was over 5 per cent., and in 15 others over 2 per cent.

The following were the 12 jails with death-rates over 10 per cent.:—

—	Death-rate per 1,000 of Average Strength.	—	Death-rate per 1,000 of Average Strength.
Mymensingh	272·1	Beerbhoom	117·5
Chumparun	193·8	Mozufferpore	116·5
Burdwan	142·8	Purneah	114·2
Bogra	122·9	Moorshedabad	107·4
Lohardugga	119·9	Backergunje	103·8
Dinagepore	117·6	Singbhoom	102·8

Since 1878 the mortality in the Mymensingh jail has been increasing at an alarming rate. In that year it was 41·0 per 1,000; in the following year it had doubled; in 1880 it reached 142·8, rising again in 1881 to 166·8. On the other hand, there was a fall in the death-rate of the Julpigoree jail, from 285 per 1,000 in 1881 to 75·3 in 1882; it is to be regretted, however, that it rose again in 1883 to 261·9 per 1,000. In the Baraset and Nuddea jails, also, the mortality declined from 208·4 and 105·7 respectively to 67·8 and 60·3. In several other jails there was a marked improvement, as the following statement shows :—

	Death-rate per 1,000.			Death-rate per 1,000.	
	1882.	1881.		1882.	1881.
Chumparun	193·8	203·8	Midnopore, *District and Central*	52·2	126·4
Bogra	122·9	124·9	Jessore	48·8	74·5
Dinagepore	117·6	185·3	Russa, *Female*	48·4	63·5
Beerbhoom	117·5	152·9	Hooghly	41·9	76·6
Rajshahye, *District and Central*	81·4	83·5	Maldah	37·9	39·8
Monghyr	80·5	94·8	Patna	37·0	39·4
Darjeeling	78·6	122·4	Manbhoom	34·9	80·9
Julpigoree	75·3	285·5	Presidency, *European*	29·1	55·7
Rungpore	73·5	83·3	Bankoora	26·9	68·6
Baraset	67·8	208·4	Cuttack	15·0	23·1
Nuddea	60·3	105·7	Pubna	11·1	49·7
Alipore, *District and Central*	56·7	58·2			

As usual, fevers and dysentery and diarrhœa were the chief causes of sickness and mortality among convicts. Of the total 25,776 admissions to hospital, over 66 per cent. were due to these causes alone, and over 53 per cent. of the total 1,034 deaths. Cholera cases rose from 179 in 1881 to 256, and cholera deaths from 81 to 146. Of these 30 occurred in the Dacca district jail, 26 in Bhagalpur, and 17 each in Mymensingh and Chumparun.

It seems to have been the general opinion among medical officers in charge of the various jails in Bengal that the unsatisfactory health of the prisoners was due to the unhealthiness of the country generally from which the prisoners came, or that part of it in which the jails were situated. "To whatever cause," it is stated in the Government Resolution on the Bengal Jail Report, "the unhealthiness of many of the Bengal jails "may be attributed, the Lieutenant-Governor is decidedly of opinion that the evil is "not due to any defects in the jails themselves. A great expenditure has been incurred "in their construction. They are palatial residences compared with the mud huts of "the native villages. Many of them, during the last few years, have been provided, at "a very heavy cost, with barracks of two and three stories in height, for the accom- "modation of prisoners at night." It is further stated that great care has been taken to supply good drinking water, wholesome food, and suitable clothing. "The fort- "nightly weighments are continued, and have resulted in many cases of failing health "having been discovered and dealt with, which would formerly have probably escaped "observation until it had become really pronounced." In the more unhealthy jails special measures have been taken: the Chumparun jail was removed to what is hoped will prove a more healthy site; the drainage of the Mymensingh jail was improved; and in several other jails improvements were effected.

Madras.

The health of the jail population of the Madras Presidency in 1882 was not quite so good as in the previous year. The total admissions to hospital rose from 737 per 1,000 of average strength in 1881 to 795, the daily sick from 28 to 29, and the death-rate from 41·91 to 42·62. These unfavourable results were entirely owing to the great unhealthiness of the central jail at Trichinopoly, which yielded 38 per cent. of the total mortality. Excluding this jail, the mortality would be reduced to 28·96 per 1,000. For some time past the health of the prisoners at Trichinopoly had been a subject of anxious consideration. Careful inspections of the jail were made during the year, but no special cause for the lamentable mortality of 176·7 per 1,000 was discovered. The Sanitary Commissioner considered that it might be due to insufficiency of rice diet. Owing to the great prevalence of bowel complaints, from which were due no less than 116 of its total 145 deaths, the water-supply was submitted to analysis, when it was found to be of very bad quality. These matters have since received attention, and the death-rate has fallen very considerably, standing at 55·14 per 1,000 in 1883. In no other jail did

the mortality approach that of Trichinopoly; the next highest was 87·8 at Tanjore. Six other jails recorded death-rates ranging from 69 to 50 per 1,000; in nineteen the death-rate varied from 46·99 to 5·70 per 1,000; while in six there were no deaths.

The returns concerning convicts only showed an admission-rate of 798 per 1,000, a daily sick-rate of 28, and a death-rate of 42·67. As regards the principal death causes among this class of prisoners, 27 deaths were due to cholera, of which all but four occurred in the Coimbatore central and district jails. Considering that cholera was more or less epidemic during the year in many other districts, this mortality is not regarded as heavy. Dysentery and diarrhœa caused the greatest number of deaths, namely, 174, or about 20 per 1,000 of average strength, and nearly a half of the total mortality. From respiratory diseases there were 21 deaths, while from fevers there were only five deaths, although the admissions equalled 241 per 1,000 of average strength.

Bombay.

The year 1882 was comparatively a very healthy one among the prisoners confined in the jails of the Bombay Presidency. Admissions to hospital per 1,000 of average strength fell from 1,076 in 1881 to 843, the daily sick-rate from 34 to 26, and the mortality from 41·88 to 33·35. Only in a few cases was the health of the prisoners unfavourable, as is shown by the fact that in four jails out of the total of 27 no deaths were recorded, in six the death-rate was very low, ranging from 10 to 15 per 1,000, in seven others from 21 to 30 per 1,000, in four from 30 to 40, in three from 40 to 60, and in the remaining three from 61 to 71 per 1,000. The six most unhealthy jails were Belgaum, Sholapur, Surat, Gokak, Nara, and Shikarpur. In the first three of these the actual number of deaths was few, only 22 in all; but in the last three there were 129 deaths, nearly one-half of the total jail mortality. At Gokak the death-rate (61 per 1,000) was considerably below that of the previous year, viz., 113. On the other hand, there was a considerable increase in sickness and mortality in the Nara gang, the death-rate having risen from 35 per 1,000 in 1881 to 61 in 1882. This increase is attributed to the transfer to the gang of some unhealthy men who were unable to stand exposure to the cold, and readily fell victims to fever and diseases of the respiratory organs. In the Shikarpur jail also the death-rate rose from 69 to 71 per 1,000. A careful inspection of this jail was made by the Inspector-General, who found its sanitary condition satisfactory, and the food and clothing sufficient; but the only reason he could assign for the great mortality from lung disease was that the prisoners caught chills in the early morning during the cold weather. He therefore ordered that they should remain in barracks until the sun rose, and that they should be permitted to smoke in the early morning. The adoption of these and other remedial measures, it was hoped, would prove effective.

The returns of the convicts for the year give an admission-rate of 834 per 1,000, a daily sick-rate of 26, and a death-rate of 33, or 8 per 1,000 less than the mortality of the previous year. Of the total 284 deaths among this class, 50 resulted from fevers, 60 from respiratory diseases, 57 from bowel complaints, 35 from anæmia and general debility, and 7 from cholera. In the previous year there were 31 deaths from cholera.

Punjab.

Judged according to the mortuary statistics, there was a marked improvement in the health of the prison population of the Punjab during 1882. The admissions to hospital were slightly in excess of the previous year, the rate per 1,000 of average strength having increased from 1,519 in 1881 to 1,546, but the daily sick-rate fell from 48 to 45, and the death-rate from 65·15 to 41·63. This decrease in mortality manifested itself among all classes of prisoners. The rate of mortality among convicts was 23 per 1,000 lower than in 1881, namely, 43·7 against 66·7; among under-trial prisoners it fell from 35·7 to 0·80, and among civil prisoners from 1·83 to 0·81. Of the total convict admissions to hospital 71 per cent. were from fevers and bowel complaints, and these diseases also yielded 51 per cent. of the deaths. Admissions from respiratory diseases were not so numerous as in the previous year, but the deaths numbered 160, or one more than in 1881. Cholera was altogether absent from the jails, whereas in the previous year there were 133 cases and 97 deaths. The jails were also free from smallpox during 1882.

As regards the mortality in individual jails, only eight recorded a death-rate in excess of the average rate of the year. The highest was 113·3 per 1,000 in the Lahore central jail, which is the largest jail in the province; but even this was an improvement on 157·4, the rate of the preceding year. In several other jails which were markedly unhealthy in 1881 there was a decided improvement. At Dharmsala the fall was very striking, from 265·6 to 51·5; at Rawal Pindi, from 201·2 to 23·3; and at

Peshawar, from 136·9 to 11·5. The decrease in the Lahore jail was entirely due to the absence of cholera; if the deaths from this disease in 1881 be deducted, the death-rate for that year would stand at 110·49, or nearly 3 per 1,000 lower than that of 1882. The Lahore district jail recorded the next highest death-rate, viz., 64·6, almost identical with the rate of the previous year. Amritsar followed with 62·7, which was 26·9 per 1,000 higher than in the year before; and Lahore female jail with 62·2, or 24·8 per 1,000 in excess of 1881.

It is satisfactory to record a further improvement in the health of the Rupar central jail, the death-rate of which fell from 55·7 to 33 per 1,000. During the year this jail was closed, and the prisoners were removed to a new central jail at Mooltan. Out of the total 35 jails in the province, 20 showed a decrease in mortality, amounting on an average to 44 per 1,000, while 13 showed an increase, the average being 16 per 1,000. The largest increase, 42·8 per 1,000, was at Shahpur. Unremitting care and attention was given to the food, clothing, accommodation, and sanitary arrangements of the prisoners, which doubtless contributed in no small degree to the general satisfactory results of the year.

North-Western Provinces and Oudh.

The vital statistics of the jails of the North-Western Provinces and Oudh for 1882 accord pretty nearly with those of the preceding year. Among all classes of prisoners the admissions to hospital equalled 724 per 1,000, or 40 less than in 1881; the daily sick-rate was 29, or 3 per 1,000 lower; and the death-rate was 22·93 against 23·78. Fevers and bowel complaints were less fatal, but there was a slight increase in cholera, due to an outbreak at the Benares central jail. Altogether there were 44 cases of this disease with 22 deaths, 14 of which occurred in the above jail.

The health of the convicts during the year was on the whole satisfactory, the admission rate having fallen from 797 in 1881 to 755, the daily sick-rate from 33 to 29, and the mortality from 23·4 to 22·8 per 1,000. Of individual jails the highest convict death-rate, 86·3 per 1,000, was recorded at Muttra. Gorakhpur followed with 70·3, Orai with 67·5, and Moradabad with 49·9. Several other jails had death-rates considerably in excess of the provincial average; but in the majority both the sick and death-rates were very low.

With few exceptions the jails were able to accommodate the prisoners sent to them during the year, though in some cases there was slight overcrowding. No pains were spared by the Inspector-General in making himself acquainted with the condition and needs of the jails. In several instances he noticed the necessity for improvement in the sanitary condition, and defects brought to light were receiving attention. The sanitary condition of the Meerut central jail, notorious for the prevalence of fever, has long engaged the attention of the Local Government, and a special committee has been ordered to report upon the site with the object of expediting a definite conclusion regarding it.

Central Provinces.

The health of the jail population of the Central Provinces during 1882 was on the whole most unsatisfactory,—owing, it appears, to the general unhealthiness of the country, and to the transference to the Raipur jail of a number of prisoners from the feudatory state of Kalahundi, "a people who," it is reported, "by habit and temperament are utterly unable to bear loss of freedom and separation from their families." Among all classes of prisoners the admissions to hospital rose from 790 per 1,000 of average strength in 1881 to 966 in 1882, the daily sick-rate from 29 to 41, and the death-rate from 29·30 to 71·05. The total deaths among convicts numbered 294 or 73·3 per 1,000 against 118 or 30·1. More than a half of this mortality (163) was attributed to bowel complaints, 135 deaths under this head having been recorded at Raipur and Nagpore jails. The mortality among the Kalahundi prisoners, who were received in a bad state of health, was very great, 78 having died in the Raipur jail and 6 in Nagpore out of a total of 381, equal to a death-rate of over 220 per 1,000. Eliminating these figures, the average death-rate of the jails (convicts only) is reduced to 52 per 1,000. This rate, although considerably in excess of 1881, compares favourably with the average of the past five years; the latter, however, includes the famine years. The Government of India, in their orders to the Local Government, had directed that the special attention of medical officers in charge of jails should be invited to the quality of the water supply in their several jails as the chief possible local insanitary condition which may have caused a portion of the increased sickness from bowel complaints.

Of individual jails the highest death-rate was recorded at Raipur, namely, 209·2, the chief cause of which has been already stated. Next come Bilaspur, 88·4; Mandla 74·0, Sambalpur 70·8, Chindhwarra 67·0, Nagpore 66·1, and Damoh 54·4. Of the

remaining twelve jails, the death-rates of nine ranged from 34·5 to 1·13, and in three there were no deaths. Only in the two jails of Sambalpur and Bilaspur was there any overcrowding during the year, and steps were taken to prevent any recurrence of this in the future.

Berar. On the whole the health of the prison population of Berar in 1882 was remarkably good. No epidemic prevailed, and in no jail were there any deaths recorded from cholera. The Inspector-General reports that "the prisoners in all the jails throughout the year have presented an appearance of rude health, and I think that it may be considered that the diet scale in 1881 has proved its sufficiency. It errs on the side of liberality, in my opinion, if it errs at all." The admissions to hospital yielded 449 per 1,000 of average strength, the daily sick-rate 12, and the death-rate 8·50, against 16·51 in 1881. All the deaths, numbering 10, occurred among the convicts, the rate of mortality among them being 8·66. In two of the six jails of the province there were no deaths, and the greater proportion of the mortality in the other jails took place among convicts of less than six months' residence. At the two largest jails, Amraoti and Akola, the admission-rates were only 300 and 328, and the daily sick-rates 12 and 9 respectively, while the deaths equalled 8·5 and 3·9 per 1,000.

Assam. There was a great decrease in mortality in the Assam jails during 1882, from 39·82 in 1881 to 33·08 per 1,000, but the admission-rate rose from 1,305 to 1,735, and the daily sick-rate from 42 to 45. The total deaths numbered 50, less by 13 than in 1881, and of these 22 were from bowel complaints, and 4 from cholera. In the previous year there were 12 deaths from cholera. This diminution in cholera mortality is satisfactory, as the disease was much more prevalent in the province during the year under notice than in 1881. Of the total 50 deaths 44 occurred among the convicts, equal to a death-rate of 32·3 per 1,000, which is a great improvement on 80·7, the rate of mortality in 1879. It is satisfactory to learn that the improvement is greatest where formerly the mortality had been worst, for example, in the Gauhati jail the deaths declined from 33 or 110·5 per 1,000 in 1881 to 12 or 18 per 1,000 in 1882. A considerable improvement is also noticed in the Dibrugarh jail, the death-rate having fallen from 115 per 1,000 in the previous year to 42·8. On the other hand, the statistics of several jails show retrogression. At Tezpur, which has hitherto been conspicuously healthy, the death-rate rose from 14·1 to 34·5, and at Silchar from 11·9 to 63·9. It is reported that this latter jail has been built under conditions very prejudicial to health, but measures were being taken to improve it. Next to Gauhati the greatest number of deaths (10) occurred at Sylhet jail, but its ratio was only 20·3 per 1,000. "When it is remembered," the Chief Commissioner remarks, "that these figures include the large gang who have been working on the Cherra road in a climate to which they are unaccustomed, and exposed to the greatest rainfall in the world, this fact speaks volumes for the healthiness of out-door labour, and for the care with which the prisoners have been looked after."

British Burma. The vital statistics of the jails in British Burma also show an increase of sickness with a diminution in mortality. The rate of admission into hospital per 1,000 of average strength rose from 883 in 1881 to 1,168, the daily sick-rate from 36 to 39, while the death-rate was 27·81 or 18 per 1,000 less than in the previous year. Among convicts only there were 112 deaths or 26·4 per 1,000 against 205 or 45·1 in 1881. Of the total convict deaths 37 were due to cholera, one more than in the preceding year, 25 to bowel complaints, and 14 to anæmia and general debility. All the cholera deaths took place in six jails out of 14. Thayetmyo yielded 21, Tavoy 7, Rangoon and Moulmein 3 each, Bassein 2, and Moulmein 1. In the previous year there was a serious cholera epidemic at Thayetmyo, resulting in 26 deaths. Its reappearance in 1882 led to the transfer of almost all the prisoners to Moulmein, when certain sanitary improvements were carried out at the jail, and arrangements made to secure a supply of wholesome drinking water. This jail has since been re-occupied.

The convict death-rates of some of the jails were very low. At Rangoon, where there was a considerable increase in admissions to hospital, it reached only 13·6 per 1,000, and at Moulmein only 18·0. The highest mortality was recorded at Thayetmyo, Tavoy, and Akyab, where the ratios of deaths to daily average strength were 323·9, 103·9, and 56·3 per 1,000 respectively. In three jails there were no deaths.

V.—VACCINATION.

Bengal.

Each year witnesses to an extension of the area of vaccination in Bengal. In 1882–83 protection from small-pox was afforded for the first time to 9,052 square miles, with a population of 4,528,084, besides which several thanahs, representing an area of 2,819 square miles (previously traversed by Government vaccinators), containing a population of 851,398, were placed under the licensed system of vaccination. The results of the year, however, were less satisfactory than in 1881–82, for the total operations declined from 1,349,607 to 1,261,425, showing a diminution of 88,182. This decrease was confined entirely to the three vaccination circles of Ranchi, Darjeeling, and Eastern Bengal, and the Municipal areas, but chiefly to the first two, and was attributed principally to opposition to vaccination, want of effective assistance from the civil authorities, prevalence of sickness, and objection to lymph being taken from the arms of children. On the other hand, some circles showed a considerable improvement, especially the Sonthal pergunnahs and Metropolitan circles.

Primary operations numbered 1,247,277, of which 98·60 per cent. were successful, and of these latter 79·14 per cent. were of children under six years of age against 73·36 in 1881–82. This is a satisfactory improvement, still the number of infants vaccinated during the first year of life is lamentably small. Assuming the general birth-rate to be 30 per 1,000, and excluding the infants who died, only 12·59 per cent. of the infants born during the year were vaccinated; but even this low estimate compares favourably with the results of the previous year, when the corresponding percentage was only 11·32.

Although much opposition to vaccination is still shown in many parts of Bengal, it is satisfactory to learn that on the whole the general feeling of the people towards it is becoming more favourable. The Sanitary Commissioner is of opinion that the only means of effectually breaking down the opposition of the people is by a general extension of the Compulsory Vaccination Act. The Lieutenant Governor, however, considers that public opinion is not yet ripe enough for such a sweeping measure. During the year the Act was introduced into various municipalities. It is now in force in fourteen towns, and since the close of the year under notice steps have been taken for its introduction into all the municipalities in the Burdwan and Presidency divisions. The influence of vaccination on small-pox mortality is shown by the fact that in unprotected areas the mortality stood as high as 0·26 per 1,000 of population, while in fairly protected areas it was only 0·09 per 1,000, and in thoroughly protected areas as low as 0·02 per 1,000.

During the year a beginning was made in the establishment of animal vaccination in Calcutta, and before its close 19 calves had been operated on. As many as 466 persons presented themselves for vaccination at the depôt, and of these 340 were primary operations; but the results were not very satisfactory, as the percentage of success was only 52·94. A larger measure of success is anticipated from the improvements which were being carried out.

Madras.

Satisfactory progress was made in vaccination work in the Madras Presidency during 1882. The total operations rose from 601,222 in the previous year to 661,133, an increase of 59,911, which was distributed over all the districts, excepting Tanjore and the Nilgiris. To a great extent the increase was due to the greater interest taken in the work by District Revenue Survey Officers and to increased zeal on the part of vaccinators. Of primary vaccinations there were 649,485, with a percentage of success of 92·6 against 91·1 in 1881. Among children under one year of age 116,934 successful primary operations were performed, being 18,642 in excess of the number of the previous year. Favourable as these results are, yet, when compared with the 751,104 registered births of the year, it is seen that there is much room for improvement. "In most "districts," the Inspector of Vaccination states, "there is a great prejudice against "infant vaccination, and, if the people can help it, they won't have the operation done "until the child is able to run alone."

Animal vaccination was conducted at the vaccine depôt from April to September with fair success. It was also started in Guntur circle in November with marked success, and it is reported that there is now always a good supply of lymph to be had in the circle. This is the more satisfactory, as in this circle great difficulty was experienced in getting the people to allow lymph to be extracted from their children's arms.

Bombay.

Vaccination continues to make progress in the Bombay Presidency. The total operations performed in 1882–83 numbered 858,711, greater by 72,619 than the number

of the previous year. Of these 792,206 were primary cases, but the percentage of success, 96·15, was 0·37 below that attained in 1881–82. All the districts contributed towards the increase excepting Sind and Aden. According to districts and circles (not including Aden) the percentages of success in primary vaccination ranged from 92·54 in the Presidency Circle to 99·32 in Cutch Circle. According to age the number of infants successfully vaccinated was 468,594, of children between one and six years 273,132, and of persons of other ages 20,019. Thus, out of every 100 persons primarily vaccinated, 61·30 were infants, and of these 59·15 were successfully vaccinated. Each year witnesses progress in the protection afforded to infants. Comparing the infants successfully operated on with those available for vaccination at the rate of 31 per 1,000 of population, it is learnt that 29·74 per 1,000 were primarily vaccinated with successful results against 27·48 in 1881–82, the increase indicating a fair improvement both in the quantity and quality of the work performed.

Animal vaccination was more extensively practised than in the previous year. In Bombay City no other lymph is used, and it is reported to be gradually taking the place of arm-to-arm vaccination in the districts.

The Compulsory Vaccination Act had been in force in Bombay five years, and so far has worked fairly well, each year showing a progressive increase in the number of infants protected. The Kurrachee Vaccination Act had been in operation in that city for three years, and through its agency a great improvement has been effected in the quality of the work performed, as is shown by the fact that in 1882–83 the total operations performed were 7,160, with a ratio of success of 94·16 against 4,625 and 92·35 respectively in the previous year.

Punjab.

The total number of persons reported as vaccinated in the Punjab during 1882–83 was 499,697 against 673,487 in 1881–82. The decrease was due chiefly to the non-receipt of the returns of the Western circle for the month of March, and to a diminution in the staff of vaccinators. In these circumstances no fair comparison of the work of the year under notice with that of the previous year is feasible. Of the total operations 496,800 were primary cases, 95 per cent. of which were successful. Of children under one year 354,414 were successfully vaccinated, equal to 50 per cent. of the registered births. The Vaccination Department as re-organized in 1881 was reported to be working satisfactorily. In many of the districts the Civil Surgeons displayed great interest in the work, and opposition on the part of the people was rapidly diminishing.

North-Western Provinces and Oudh.

Hitherto the apparent progress made in vaccination work in the North-Western Provinces and Oudh has been noticed with satisfaction. It appears, however, that to a great extent the progress was fictitious, false returns having been made by vaccinators in the second circle, comprising the Oudh, Rohilcund, and Kumaon divisions.

The total number of persons vaccinated in the whole province in 1882–83 was 672,463, less by 94,796 than in the preceding year. Of these 653,669 were primary cases, and the percentage of success equalled 91·60. Only about 15½ per cent. of the children born during the year were vaccinated, showing the great need for an extension of vaccination.

According to circles, the results of the first, comprising the 13 districts of the Meerut and Agra divisions, were very satisfactory. The successful primary operations rose from 183,746 in the preceding year to 192,369, and it is estimated that about 64 per cent. of the infant population was protected during 1882.

In the second circle, consisting of 22 districts of the Oudh, Rohilcund, and Kumaon divisions, there was a decrease of 93,195 successful primary cases, the total number being 164,377, against 257,572. In the Oudh division alone there was a falling-off of 52,419; and the Sanitary Commissioner believes that no more than 11 per cent. of the infants born were protected from the ravages of smallpox. During the year an experiment was tried in the Bareilly district of employing female vaccinators, and is said to have proved successful.

In the third circle, containing the 16 districts of the Jhansi, Allahabad, and Benares divisions, the successful primary operations numbered 242,160, or 548 below the previous year. Of this number 79,301 were infants under one year of age, equal to 17·3 per cent. of the estimated births. This low average, it is reported, was chiefly due to the backward state of vaccination in the eastern districts, but steps have since been taken for increasing the vaccination staff.

Central Provinces.

The work of vaccination continued to make satisfactory progress in the Central Provinces, and was on the whole reported to be admirably conducted. During 1882–83 there were 433,691 operations performed by the Vaccination and Dispensary Departments, being 36,909 over the number of the previous year. The successful primary operations

were 400,576, or 92 per cent. of the total vaccinations. Of these 174,210 were in children under one year of age, and 198,994 between one and six years. In some districts, however, there were special causes which interfered with vaccine work. In a few cases the lymph was found to be insufficient, while in Balaghat district the operations are stated to have been so clumsily performed, and to have been attended with such disastrous results, as to cause the mothers of children to dread vaccination. Arm-to-arm vaccination was more extensively carried out during the year; but directions were given that where the people objected to this process, and, on the other hand, looked upon lymph taken from tubes "as medicine," as was the case in Wardha district, efforts should be made to humour the preference, and that, when it was not possible to do so, the operations of the vaccinators should be closely supervised.

Successful work is also reported to have been carried on in several Native States and zamindaris. "There is no doubt," it is reported, "that the supersession of inoculation by "vaccination in these States is merely a matter of time; the attention of the Chiefs has "been for some time directed to this matter."

Berar.

The results of vaccination in Berar for 1882–83 were again very satisfactory, and the work accomplished was greater than in any previous year. The combined operations of the vaccination staff and dispensaries were 110,291, or 14,870 above the number of the previous year. Of these 110,009 were primary cases, 91·6 per cent. being successful, against a corresponding ratio in 1881–82 of 89·8. Each district contributed to the increase, except Akola, where there was a slight falling-off. Improvement was most marked in Buldana, where the vaccinations were 53 per cent. greater than in the preceding year, Amraoti coming next with an increase of 17 per cent. Estimating the birth-rate at 40 per 1,000 of population, the number of infants successfully vaccinated was 55·4 per cent.

Further progress was made in vaccinating the timid people of the Melghat hills. In three months of the year a vaccinator attached to the camp of the Deputy Conservator of Forests performed 495 operations, with a percentage of success of 88·1. The work was to be pushed on with more energy, as the people become more reconciled to seeing the vaccinator in their villages, and they come to understand that no hurt is intended to them or their children.

No active opposition to vaccination is experienced in the province, and hopes are entertained that in a few years a very considerable proportion of the population may be protected from smallpox. The fact that the number of successful operations has more than trebled in the last ten years is an encouraging proof of the advancing popularity of the treatment.

Assam.

Good progress was made in vaccination work in Assam during 1882–83. The total operations numbered 58,537, including 2,243 reported to have been performed in tea-gardens and 698 at the Dhubri coolie depôt. The results of the latter, however, could not be ascertained, owing to the coolies proceeding up the river to their destinations. Excluding these 698, the work of the year shows an increase of 12,593 operations over the number of the previous year. In several districts there was an increase, but chiefly in Sylhet, where the number of operations by Government agency exceeded that of the preceding year by 14,251. On the other hand, the four districts of Khasi Hills, Garo Hills, Kamrup, and Sibsagar showed a decrease, especially the last, where the vaccinations were less by 6,279; this was attributed to the abandonment of the untrustworthy agency of ex-inoculators formerly employed, upon whose returns little reliance could be placed. Of the total 57,839 operations, 57,619 were primary cases, 89·4 per cent. being successful, a ratio nearly 2 per cent. higher than in 1881–82. Among children under one year of age there were only 6,284 primary successful operations, while among those between one and six years the number was 32,114.

As regards the attitude of the people of the province towards vaccination, the Chief Commissioner states that the prejudices of the people have been considerably magnified. He says that wherever he has made inquiries on the subject in the Assam Valley districts, he has found that if any such prejudice exists it is based, not on any religious grounds (except in the case of one or two sects), but simply on the conservative tendencies of the people, to the mass of whom vaccination is altogether a new thing. He is of opinion that a good deal of the prejudice is due to the mischief done by ex-inoculators, and that with their abolition, and an increase in the staff of vaccinators, with more effective supervision on the part of civil surgeons and superintendents, no serious opposition will be offered by the people.

In British Burma the vaccinations increased from 51,106 in 1881-82 to 55,626. Of these 55,095 were the work of the vaccination staff, 52,342 being primary cases, and 44,704 or 85·34 successful, against a corresponding rate in the previous year of 80·2. Among children under one year of age only 8,346 were successfully vaccinated, little more than a tenth of the registered births, showing that much still remains to be done before the infantile population is protected. During the year the Vaccination Establishment was strengthened by the addition of one native superintendent and 17 vaccinators, but the work done by each was less than in the previous year. Judged, however, by the rate of success, the quality of the work has improved; and it is believed that if a continuous supply of active lymph were available, the number, with a little more energy, might be doubled. Efforts were made during the year to establish animal vaccine depôts at Thayetmyo and Toungoo, but without success. More satisfactory results were obtained at Rangoon, and arrangements have since been made for the establishment of a permanent vaccine depôt there. British Burma.

VI.—MEDICAL INSTITUTIONS.

Civil Hospitals and Dispensaries.

Bengal.

The work of reform in the constitution and management of the charitable dispensaries of Bengal, which had made considerable progress in 1880 and 1881, was suspended in 1882 in consequence of the important changes which it was anticipated the projected scheme of local self-government would involve in the status of these institutions. Satisfactory progress was made in transferring the management of the institutions to local bodies and private committees. Twenty-six dispensaries belonging to the second or aided class were so transferred to the first class, and were rendered independent of Government aid, while of the 111 nominally in the second class no less than 70 were transferred to the charge of the municipalities within which they are situated, and are now supported by funds made available by the assumption by Government of the charges for police.

The year opened with 231 dispensaries at work, but before its close the number was reduced to 223, eight having been closed on the ground that they were serving no really charitable purpose. At these 957,623 patients were under treatment, 23,468 of whom were in-patients, as against 947,534 and 23,444 respectively in the previous year. Among in-patients the death-rate was 158 per 1,000, almost identical with that of 1881. The mortality, however, varied very considerably at the different dispensaries, the highest rates were 931·5 per 1,000 at Goalundo and 454·5 at Ranaghat; the lowest were 19·6 at Madaripore and 27·2 at Palamow. In explanation of these variations it is stated that in some cases a few persons only were admitted in a hopeless condition, while in others "exhausted pilgrims, unable to continue their journey, have been dropped at the "dispensary as the only refuge open to them. In others, again, a few decrepid paupers "have been kept in charity as dispensary patients."

The income from all sources amounted to 43,465*l.*, of which 4,127*l.* were contributed by Government, the remainder being made up from various local sources. The Government grants to the Bengal dispensaries in the previous year amounted to 10,638*l.*, the large reduction which has since taken place being due to the transfer to municipalities of the cost of maintaining the dispensaries within their limits. The total expenditure exclusive of invested capital amounted to 34,576*l.*

The statistics of the Calcutta hospitals show a considerable decrease in patients compared with the previous year. At the six hospitals the number under treatment during 1882 was 253,083 against 275,414 in 1881, a decrease of 22,331. As shown in the following table, the fall was almost entirely among out-patients, the number of in-patients being nearly the same in both years, viz., 20,764 in 1881 and 20,579 in 1882.

Medical Institutions.	1882.				1881.			
	Total Treated.			Died per mille of treated.	Total Treated.			Died per mille of treated.
	In-door.	Out-door.	Total.		In-door.	Out-door.	Total.	
Medical College Hospital	5,448	39,329	44,777	122·5	5,381	59,085	64,466	128·69
General Hospital	3,295	—	3,295	44·91	2,863	—	2,863	47·85
Mayo Hospital and Dispensaries	2,125	182,163	184,288	178·64	2,125	183,354	185,479	155·87
Campbell Hospital	5,609	—	5,609	247·83	6,074	—	6,074	237·4
Municipal Police Hospital	2,488	—	2,488	13·53	2,681	—	2,681	13·05
Total Calcutta Hospitals	18,975	221,492	240,467	138·89*	19,124	242,439	261,563	138·21
Howrah General Hospital	1,604	11,012	12,616	190·5	1,640	12,511	14,151	192·07
Grand Total	20,579	232,504	253,083	143·73	20,764	254,950	275,714	142·68

* Reckoned on the cases treated, exclusive of those of the Eye Infirmary.

It will be seen from this table that only in three hospitals were out-patients treated, and that in all there were fewer cases than in the previous year; but the decrease is chiefly noticeable in the Medical College Hospital and the Howrah General Hospital. In the former of these, however, the fall in numbers was only apparent, for it is reported that "an erroneous method of entering cases as new, which were not new, was corrected "in 1881. The correction reduced the figures of 1882 by upwards of 15,000. Further, "up to September 1881 there had been an objectionable practice of treating in private

" rooms as out-patients persons who had no right to hospital treatment. This was " stopped, but not until it had added 4,198 cases to the records of 1881." It appears that the total number of new cases properly so considered among the out-patients of 1882 was 31,537. The decrease in in-patients was confined entirely to the Campbell, Howrah, and Police Hospitals, but chiefly to the first of these three. This is somewhat remarkable, as during part of the previous year a large portion of the building was closed for repairs, consequently the accommodation was much reduced. The diminution in the number of admissions was attributed to a less prevalence of fevers and dysentery. Altogether there were 2,886 deaths among the in-patients, equal to a death-rate of 143 per 1,000 of all cases except those treated in the Eye Hospital, against 142·68 per 1,000 in 1881. Of the total deaths 468 were from cholera, being 164 more than in the previous year. Excluding cholera, the death-rate was remarkably low, only 125 per 1,000 against 131 in each of the two preceding years; and it was lower than in any year except in 1877, when it was 123 per 1,000. As regards other diseases treated in hospital, fever cases were less by 693 than in 1881, and the mortality fell from 365 to 338 or 90·7 per 1,000; from dysentery and diarrhœa the deaths also fell from 913 to 864. At the various hospitals 1,000 important surgical operations were performed, including 292 operations on the eye. Adding cases remaining under treatment at the close of 1881 the number was 1,081. Of these 738 were cured, 119 were relieved, while 72 proved fatal. The minor operations performed during the year numbered 17,707.

The income of the Calcutta hospitals amounted to 39,624*l.*, nearly 60 per cent. being contributed by Government; the total expenditure amounted to 36,930*l.*

Madras.

The number of dispensaries in the Madras Presidency rose from 255 in 1881 to 275, 20 new institutions having been opened in 1882, most of them being intended only for out-patients. In these there were 1,538,576 patients under treatment, a greater number than in the previous year by 88,984. Of in-patients there was a slight increase of 133, the total being 37,456, which, however, was still much below the number of the years immediately following the famine. "There is but little tendency," it is reported, " for in-patients to increase in normal years. Local authorities are obliged, from financial " necessities, to restrict the number dieted at the public expense to cases of urgency." On the other hand, there has been a large and continuous increase in the number of out-patients, the great majority of new institutions established since 1876 having been intended for patients of that class. Among the in-patients there were 2,681 deaths, equal to 71·6 per 1,000, which was a fraction higher than the mortality of 1881, but below the general average.

Of the chief diseases under treatment there were 10,131 cases of cholera against 3,311 in 1881; but only 319 were treated in hospital, and of these 177 proved fatal against 181 cases and 110 deaths in 1881. From small-pox also there was an increased mortality among the in-patients; while from fevers the admissions continued to decline, which is regarded as a very satisfactory indication of the condition of the people. From dysentery and diarrhœa there was a slight increase in admissions and mortality, but not out of proportion to the general increase of patients. Cases of skin diseases and ulcers were more numerous than in any previous year, as were also the admissions from syphilitic diseases, which was due in some measure to the opening out of new centres of relief. Surgical operations show a steady increase. The major operations of the year numbered 2,811, or 239 more than in 1881.

The total income of the institutions rose from 79,313*l.* in 1881 to 81,106*l.*, of which 27,317*l.* were Government contributions; the expenditure amounted to 78,194*l.*

Bombay.

In the Bombay Presidency medical relief was dispensed at 41 civil hospitals, the same number as in 1881, and at 158 dispensaries, 12 of which were opened during 1882. The popularity of these institutions is shown by the yearly increasing attendance. The total number of patients under treatment was 1,320,185 against 1,275,494 in 1881, the in-patients numbering 35,111 against 35,679. There was thus an increase of 45,259 out-patients, and a decrease of 568 in-patients. Of the latter class 2,491 or 71 per 1,000 died, a lower ratio than that of 1881 by 10 per 1,000. Malarious fevers as usual gave rise to the greatest number of admissions, and were equal to over 19 per cent. of the total. Cholera cases fell from 3,957 to 2,520; cases of dysentery and diarrhœa were also less numerous; but the admissions from skin diseases continued to rise, the number for the year being 162,647, or 8,852 more than in 1881, while, on the other hand, there was a slight fall in the admissions from syphilis. A further proof of the popularity of the Bombay hospitals and dispensaries is shown in the increase of major surgical operations. Of these 4,461 were performed during 1882, which, added to the 110 under

treatment at the beginning of the year, gives a total of 4,571 against 3,617 in 1881. The number cured was 3,985, and 180 died.

It appears that the want of an obstetric ward in the European General Hospital has long been felt, and that the old building at the Jamsetji Jijibhoy Hospital is totally inadequate for present needs. To meet the want a benevolent Parsee gentleman has given 12,000*l.* In Thana also there is a prospect of a new hospital being built by private munificence.

The Surgeon-General testifies to the efficient management of the institutions, and reports that the medical and surgical work is of the highest and most scientific order.

The total income amounted to 96,587*l.* against 93,396*l.* in 1881. Of this amount Government contributed 75,315*l.*, and 18,152*l.* were from local and municipal funds and other miscellaneous receipts. The expenditure in 1882 was 90,306*l.* against 89,934*l.* in the previous year.

Punjab.

Five new dispensaries were opened in the Punjab during 1882, and one was closed, making a total of 189 at work during the year. At these the number of applicants for relief was 1,617,024, more than in 1881 by 71,216. The increase, however, was not general, as in many dispensaries there was a decrease, while in others the increase was proportionately very large. As previously stated the province was remarkably exempt from cholera and small-pox during the year under review; but in some districts malarial fever was very prevalent, consequently the admissions from this cause were very high, the number being 353,701 against 341,845 in 1881. There was also a very great increase in cases of ophthalmia, but this was attributed more to the increasing popularity of the institutions than to any increase of disease. Respiratory affections contributed very largely to swell the attendance at the hospitals and dispensaries. In cases of dysentery and diarrhœa there was a decrease, but only in the institutions of the eastern districts; for in the western districts, where the prevalence of fever was great, there was a considerable increase. There was an increase in the number of ulcers, for which over 10 per cent. of the total patients were treated. The aggregate number of in-patients treated was 38,619, or 1,608 above the figures of the previous year. Among these there were 2,166 deaths, equal to 56 per 1,000, against a death-rate of 72 per 1,000 in 1881. The highest death-rate was 177 per 1,000 in the Amritsar hospital; in the Delhi and Mooltan hospitals the mortality was over 120 per 1,000, and in the Mayo hospital at Lahore it reached 90 per 1,000. The lowest death-rates were recorded at the hospitals of Marden and Peshawar, namely, 17 and 18 per 1,000 respectively. There was an increase of 22 per cent. in the number of major surgical operations as compared with the previous year, a further proof of the popularity of the institutions.

Many improvements were effected at several of the buildings. During the year His Excellency the Viceroy laid the foundation stone of the Ripon hospital at Simla, and the Delhi municipality have agreed to construct a large hospital in the suburbs. In future years the maintenance of the medical institutions will, with few exceptions, be entirely transferred to local bodies. The increased responsibilities which will thus be imposed upon them will, the Lieutenant-Governor hopes, lead to more efficient administration and largely extended usefulness and popularity.

The total income of the institutions in 1882 amounted to 37,715*l.* against 35,141*l.* in the previous year, and the expenditure to 36,111*l.*, of which 3,085*l.* were spent on the construction and repair of buildings.

North-Western Provinces and Oudh.

The number of dispensaries and hospitals open in the North-Western Provinces and Oudh during 1882 was 212, the same as in the previous year. The result of the year's work show that 1,697,598 persons received medical treatment, of whom 43,631 were in-patients, and 1,653,967 out-patients against 1,550,830 and 40,977 respectively in 1881. It is explained, however, that the figures are open to doubt, as the Surgeon-General had reason to believe that the returns, especially at branch dispensaries, at a distance from the Sudder station, were sometimes manipulated by the assistants in charge. Of the chief diseases under treatment cases of autumnal fever showed a considerable decrease, and the total fever admissions fell from 317,558 in 1881 to 286,700. There was, on the other hand, a considerable increase of cholera patients, the number having risen from 1,253 to 7,292. Rheumatic affections also showed an increase, but there was a decrease in cases of venereal diseases of over 4,000,—which is very satisfactory, the more so as in previous years syphilitic cases had developed enormously amongst the lower classes. Admissions from respiratory affections were fewer than in the previous year, but from dysentery and diarrhœa the cases were 7,540 in excess of 1881; the patients under treatment for skin diseases also rose from 271,560 to 309,245, showing an increase of 37,685.

Among the in-patients there were 3,360 deaths, equal to 77 per 1,000 of the total number, against 76 per 1,000 in 1881.

The year's work shows a satisfactory increase in major surgical operations, the number performed (10,613) being 2,325 more than in 1881. Of these 7,578 were successful and ended in cure, while 245 died. Out of 3,674 cataract cases 2,435 resulted in improved eyesight.

The receipts of the institutions during the year amounted to 40,299*l.*, of which a little more than half, or 20,648*l.*, was contributed by Government. The amount expended was 38,511*l.*

Central Provinces.

One new dispensary was opened in the Central Provinces during 1882, making a total of 82 at work in that year. The total number of persons under treatment was 592,843, or 39,168 more than in 1881, an increase which occurred entirely among out-patients, for the number of in-patients fell from 8,159 to 7,895. The health of the latter class of patients was not so good as in the previous year, the mortality having risen from 96·6 to 121 per 1,000. Although the year was considered less healthy than 1881 the admissions under malarious fevers were fewer by 1,818; in cholera cases there was a falling-off of 2,891, and in respiratory affections of 2,960. The increase in attendance was chiefly due to ophthalmia, the cases from which were 17,221 in excess of the number of the previous year; from dysentery and diarrhœa also there was an increase of 6,665 in the admissions; and from skin diseases an increase of 3,629 as compared with the figures of the previous year. Of surgical operations there was a decrease of 1,042 in the minor kind, and an increase of 10 in the major, the totals for the year being 17,069 and 577 respectively.

The income of the dispensaries for the year exclusive of cash balance was 10,528*l.*, nearly a half of which was contributed by Government; the expenditure amounted to 10,426*l.*

Berar.

The number of civil hospitals and dispensaries open in Berar during 1882 was 36, the same as in the previous year; but the patients under treatment rose from 157,098 in 1881 to 181,010. Of these 2,091 were in-patients, less than the number of the previous year by 189, and 178,919 were out-patients, against 154,818, showing an increase in 1882 of 24,101, which alone is considered sufficient evidence of the usefulness of the institutions. Among the 2,091 in-patients there were 109 deaths, equal to 52 per 1,000, 14 per 1,000 greater than the ratio of 1881. The proportionate prevalence of the five most common diseases to total patients was as follows, fevers 22·6 per cent., ophthalmia 9·7, skin diseases 6·6, ulcers 6·4, respiratory affections 6·3, making a total of 51·6 per cent. A further proof of the usefulness of the institutions is shown in the increase in surgical operations, the major kind numbering 266, or six more than in 1881, and the minor class 7,546, or 1,097 in excess.

A suggestion was made by the Inspector-General that a depôt should be established at Akola for the preparation and issue of drugs prepared from indigenous materials to take the place of expensive European medicines. The proposal was approved by the Resident, and it remained only for the Inspector-General to submit definite proposals for giving the plan a trial.

The receipts of the institutions amounted to 10,841*l.* against 10,273*l.* in 1881, and the expenditure was 9,526*l.* against 9,262*l.*

Assam.

In 1882 three new dispensaries were added to the 25 which were open in Assam in 1881, but neither of them was in full working order during the whole of the year. Patients under treatment rose from 58,001 in 1881 to 64,752, of whom 3,229 were in-patients. At the newly established institutions only 708 patients were treated, so that the above increase was due chiefly to the better working of the old dispensaries rather than to the additional work of the new ones. Of the 3,229 in-patients about two-thirds were immigrants supposed to be tea-coolies, the remaining one-third being natives of the province. It is stated in the Government Resolution on the Surgeon-General's report that "the Chief Commissioner trusts that, as the new local boards (more "especially those constituted by popular election) realise more completely their duties "and responsibilities in the administration of the funds committed to their charge, they "will succeed in discovering how to make these institutions more generally useful to "the population which they represent. At present, as the above figures show, they "are, mainly aids to the tea-industry, and their inmates either coolies under contract "or pauper immigrants whose service on their gardens has expired."

The proportion of deaths among the in-patients rose from 168·3 per 1,000 in 1881 to 182·4 in 1882. The places showing the highest death-rates were Goalpara (380·4),

Dibrugarh (305·2), Jorhat (270·8), Nowgong (266·6), and Tezpur (262·1). At the second and last of these the numbers were, it is believed, swelled by coolies attacked by cholera, who were transferred to the dispensary on the arrival of the steamers conveying them.

There is nothing special to notice in the diseases under treatment, except that, owing to the prevalence of cholera, the admissions from that disease rose from 149 in 1881 to 888. A satisfactory feature of the year was the increase in surgical operations from 2,131 to 2,463, of which 144 were major operations, nearly double the number performed in 1881.

The financial working of the dispensaries showed an income of 4,351*l.* against 3,771*l.* in 1881, and an expenditure of 3,927*l.* against 3,546*l.*

British Burma.

The number of dispensaries open in British Burma during 1882 was 28, one of which, at Toungoo, was new. With four exceptions, they were all under the management of municipal or town committees, and were supported by municipal funds. The yearly increase in the number of patients testifies to the popularity of the institutions. In 1881 there were 9,886 in-patients and 111,912 out-patients; these rose to 11,205 and 122,971 respectively in 1882, or over 10 per cent. on the whole. The returns show that for the past three years the diseases under treatment have remained almost constant, but cholera being much more prevalent in the province during 1882 the admissions increased from 136 to 307. Of the in-patients 6,871 were discharged as cured, and 823 or 73·4 per 1,000 died. In surgical operations there was an increase of 451, the number performed during the year being 3,321 against 2,870 in 1881. The major operations numbered 193 against 116 in the previous year.

Coorg.

At the two dispensaries in Coorg, situated at Mercara and Virarajendrapet, 10,374 patients sought relief, 458 of whom were in-patients against 429 in 1881. Among this class there were 76 deaths, equal to 165 per 1,000, an increase of 35 per 1,000 over the ratio of the previous year. The increase in the number of patients, as well as the rise in mortality, is ascribed to the general unhealthiness of the year consequent upon the prolonged monsoon.

Lock Hospitals.

Working of the Contagious Diseases Act.

The year under review was the first completed year of the restricted working of the Contagious Diseases Act in Calcutta. From its introduction in 1869 to the 1st November 1881 the Act applied to the whole town and all its immediate suburbs; but from that date its limits were restricted to the southern portion of the town and to those neighbouring parts of the suburbs which were inhabited by women in the habit of receiving soldiers and seamen. It was soon found that the Act in its restricted form could not be maintained, and the Government of India therefore recommended its repeal. The Secretary of State did not assent to this recommendation, but left it to the discretion of the Government, if it thought fit, to permit it to fall generally into abeyance or to suspend its operation. The Act was subsequently suspended in Calcutta; but no final action has been taken by the Governments of Madras and Bombay, who were of opinion that the operation of the Act had to some extent been beneficial.

Bengal.

The curtailment of area in Calcutta in 1881 in the operation of the Act led to an immediate reduction in the number of registered women, and at the close of that year there were only 1,847 on the registers against 7,001 at the end of the previous year. By May of 1882 the number had further fallen to 1,832, but from that time it gradually increased until, at the end of the year, there was an average of 1,888 women on the registers. Of these 878 were Hindu women, who, to preserve their caste, never receive Europeans. They were, however, kept on the registers, but were not subjected to examination; virtually, therefore, the Act was in force only as regards 969 women at the beginning and 1,010 at the end of the year. The total number of new registrations during 1882 was 129, all being voluntary. There were 701 defaulters from examination, of whom 62 per cent. were arrested. Upon examination 25·5 per cent. of the newly registered women were found to be diseased, and among the defaulters the cases of disease rose from 9·4 per cent. in 1881 to 19·3, a higher percentage than had ever been reached since the introduction of the Act. The number of venereal cases of all kinds treated in hospitals was in the proportion of 45·7 per cent. of the average number of women on the registers, against 42·4 per cent. in 1881. "What, however," the Officiating Superintendent of the Calcutta Lock Hospitals states, "is perhaps more important, as "bearing on the health of the registered women, is the fact that there was in 1882 a

" much larger proportion of the severer forms of venereal disease among them than was " the case in 1881, and the increase of these forms of disease is in even greater " proportion than I have shown the increase of all kinds of venereal disease to have " been." In 1882 27·6 per cent. of the average number of the women on the registers were affected with the four more aggravated forms of the disease against 13·0 per cent. in 1881.

Among the troops garrisoned at Fort William the percentage of cases of venereal disease, calculated on the mean strength of the garrison, was 14·5, nearly 6 per cent. higher than in 1881, and higher than had been recorded in any year since the introduction of the Act. These facts, in the opinion of the Lieutenant-Governor, tended to show that the Act in its restricted form could not be maintained, and that, as regards the military as well as the civil population of the town, it was necessary to move either in one direction or in the other.

Of the four cantonment lock hospitals in Bengal the results obtained at Dum Dum and Darjeeling showed a considerable improvement. At Dinapore the results were satisfactory, while at Barrackpore the admission-rate, though much lower than in 1881, was still high.

The improvement which had been effected in 1881 at Dinapore was practically maintained in 1882, the admissions numbering 149, or 162 per 1,000, against 146, or 148 per 1,000, in the previous year. These good results are again attributed chiefly to the fact that cases were brought to hospital as soon as detected. The number of women on the register at the beginning of the year was 78, but at its close there were only 65. Among them there were 168 admissions to hospital, and the average daily sick was 17·22.

Although the admission-rate among the troops stationed at Barrackpore during the year was much lower than in 1881, the results of the lock hospital were far from satisfactory. The admissions numbered 57 or 216·73 per 1,000 of strength against 305·26 in 1881. For primary syphilis there were 23 admissions. The registered prostitutes at this station at the beginning of 1882 numbered 43, but the year closed with 26 only. The number found diseased and admitted into hospital was 64 against 96 in 1882, but only six cases were reported as having been of a specific infecting character.

At Dum Dum the number of admissions to hospital among the garrison troops was 104 or 139·59 per 1,000 of average strength, less by nearly one-half than the ratio in 1881. Under all forms of venereal disease the admissions compared favourably with those of the previous year, and the medical officer believed that syphilis was being gradually stamped out. The average number of women on the register during the year was 31, among whom there were 33 admissions to hospital, eight of which were from primary syphilis.

There was a remarkable decrease in venereal disease among the troops in the Jellapahar cantonment of Darjeeling. The strength of the depôt was slightly greater than in 1881, but the admissions to hospital fell from 68 or 284·5 per 1,000 to 27 or 111 per 1,000. Eleven of the admissions, however, were from primary syphilis. The year opened with 10 women on the register, but at its close there were only 4; prostitution is, however, reported to widely exist in the district. Since November of 1882, the rules for inspecting and controlling houses of ill-fame and for preventing the spread of venereal disease, under Cantonment Act XXII. of 1864, have been extended throughout the boundaries of the Darjeeling municipality, a measure which it was hoped would strengthen the hands of the cantonment authorities.

Madras.

At all the seven military lock hospitals in the Madras Presidency there were fewer women on the registers in 1882 than in the previous year. This fact, however, does not point to any appreciable decrease in the number of women practising prostitution, but rather shows that they had been more successful in evading the detective agency. From all forms of venereal disease amongst British troops the admission-rate was 257·09 per 1,000 of strength against 239·47 in 1881. Of the seven stations the returns of four, viz., Bangalore, Kamptee, Secunderabad, and Wellington, were not so favourable as those of the previous year. The lowest admission-rate (138·02 per 1,000) was recorded at Cannanore, and the highest (394·90) at Bellary. At Bangalore and Secunderabad the rates were very high, reaching 322·27 and 262·43 per 1,000 respectively. Clandestine prostitution in the vicinity of barracks was the chief cause of these high admission rates. " In fact," the Surgeon-General of Her Majesty's Forces reports, " the good " effected by lock hospitals in curing disease has no appreciable influence whatever " towards the reduction of venereal complaints amongst the troops, and never can have, " so long as there are in every station probably 10 or more prostitutes of the class " frequented by the soldier at large, for every one under surveillance. As charitable " institutions, lock hospitals, like dispensaries, no doubt do a great deal of good in the

" shape of gratuitous medical aid to an unfortunate class of the people, but, so far as " their original object is concerned, viz., the protection of the British soldier from " disease, they have been and are a complete failure."

The Surgeon-General with the Government of Madras observes, with regard to the prevalence of diseases of this class in the country generally: " The extent to which " the syphilitic virus has affected the rural populations, who live far from the madding " crowd' of town or cantonment life, is very lamentable. Some of the worst and most " intractable cases of syphilis in females I have ever seen came under my notice during " inspection tours of 1882, and it was noticeable that these cases came from rural " villages, and not from great centres of population. Whatever may be said against the " legal control of prostitution, there is no doubt that the measures adopted in this " country have favourably modified the type of disease as it presents itself amongst the " females subject to cantonment rules. The medical practice of all our large civil " hospitals shows but too clearly the extent to which this special class of maladies affects " the health and undermines the physique of the native population."

Bombay.

Generally speaking, venereal diseases continued to decrease at the 12 stations in the Bombay Presidency where lock hospitals are maintained, and the cases under treatment in 1882 were of a much milder character than formerly. Only at the two stations of Aden and Kurrachee was there any increase, and at the former of these the excess is reported as having been due to imported cases. According to the report of the Surgeon-General, the total admission-rate of the lock hospitals was 184·3 per 1,000 against 235·6 in 1881, which was made up of ratios ranging from 72 per 1,000 at Aden to 219 at Mhow. At non-protected stations these diseases continued to increase, owing principally to women not wishing to be placed on the registers seeking refuge at stations where the Contagious Diseases Act was not in force. " It is a painful subject for " reflection," the Surgeon-General of the Bombay Army remarks, " how greatly " venereal disease has increased in this country since the mutiny. Twenty-five years " ago the disease gave but little trouble, as it was rare amongst soldiers, and four or five " cases in a hundred sick in a hospital was thought a high figure, but of late years this " disease has stood next to fevers in point of numbers, and I have myself known 50 " cases to be in the hospitals in Poona at one time out of a strength of only 1,500 men " in the garrison, and it is not now confined to British soldiers as it used to be, but has " greatly spread amongst the sepoys in Native regiments, and even civilians suffer " severely from it in the present day."

North-Western Provinces and Oudh.

As in 1881, 18 lock hospitals were open for the benefit of the military stationed in the North-Western Provinces and Oudh during 1882. The results of the working of the system were not satisfactory, for, notwithstanding that the average strength was less by over 1,100 men, the admissions to hospital on account of venereal diseases rose from 3,340 or 232 per 1,000 in 1881, to 3,506 or 264 per 1,000 in 1882. The mean ratio of the preceding five years was 255 per 1,000. The year under notice, therefore, not only compares unfavourably with the exceptionally successful year of 1881, but also with the normal results of several previous years. Although on the whole the results in 1882 were so unfavourable, some stations recorded ratios considerably below the average. The mean of the seven lowest (ranging from 103 to 208 per 1,000) was 146 per 1,000, while the mean of the remaining 11 stations (ranging from 218 at Muttra to 385 at Moradabad) was 317 per 1,000. The evidence deduced from the local reports shows pretty clearly, the Deputy Surgeon-General points out, that success attended the working of the scheme wherever the registered women were in adequate force, and the soldiers efficiently hindered in their intercourse with unregistered women, and that failure attended the working of the scheme wherever these two requirements were absent.

There were 1,677 prostitutes registered during 1882 against 1,756 in 1881. The number of cases of all forms of disease discovered was 3,117 against 3,336 in 1881. Both amongst the soldiers and the women there was a decrease of disease at the six stations of Allahabad, Cawnpore, Benares, Moradabad, Shahjahanpore, and Sitapur, also at Roorkee in the case of the women; and, but for an increase at Meerut, Ranikhet, and Lucknow, the year's results would have been satisfactory. " This co-relation of excessive disease and lessened disease amongst the registered women and soldiers of the " same stations," it is reported, " seems to indicate plainly that either the women cause " disease to the soldiers, or that the soldiers cause disease to the women. But the " weight of opinion favours the belief that both are in fault. And it certainly indicates " clearly the extreme importance of frequent medical examination of the registered " women, if not at all times, certainly whenever disease commences to increase amongst " the soldiers."

The results of the working of all four of the lock hospitals in the Central Provinces in 1882, namely, at Pachmari, Saugor, Kamptee, and Jubbulpore, show an increase in the number of men admitted into hospital on account of venereal disease and a higher ratio per 1,000 of strength. At Pachmari the admission-rate of the troops was 97·08 per 1,000, at Jubbulpore 491 per 1,000, and at Saugor and Kamptee during the period of occupation 284 and 159 per 1,000 respectively. Complaints continued to be made by medical officers of the number of unregistered women allowed to loiter in the neighbourhood of the barracks, and the want of vigilance on the part of the police in detecting them. The Chief Commissioner of the provinces, however, was inclined to attribute the increase of disease to fortuitous cases, and not to any laxity of precaution. Central Provinces.

In British Burma lock hospitals are maintained at Rangoon, Thayetmyo, Toungoo, Akyab, Bassein, and Moulmein; but only in the first three were British troops stationed in 1882. At Rangoon the daily average of patients exceeded the number for which accommodation is provided in the hospital, and the buildings at Toungoo and Akyab were found unsuitable. A new hospital has been built at Toungoo, the cost being met partly by the municipality and partly by the Military Department. The average strength at the above three stations was 1,725, and among these men there were 329 admissions for venereal diseases, or 191 per 1,000 against a ratio of 125 in 1881. All three stations recorded admission-rates much higher than in the four preceding years. Of the total 329 cases 77 per cent. were contracted in the province. The average number of women on the registers during the year was 579 against 613 in 1881, and the average daily number in hospital was 105 against 113 in 1881. British Burma.

Lunatic Asylums.

The total number of lunatics in the five asylums in Bengal in 1882 was 1,056, less by 38 than the number in confinement in the previous year. Of these 165 were primary admissions and 23 re-admissions, against 188 and 25 respectively in 1881. The decrease in new admissions was unexpected, and showed that the effect of the orders of the Government restricting the admission of non-criminal and harmless lunatics was not entirely exhausted. The number of recoveries in the course of the year was 83, while 34 patients were transferred to the care of friends, 87 died, and 2 escaped, leaving 850 still under treatment at the end of the year, of whom 318 were criminal lunatics. The proportion of recoveries, calculated upon the average strength, was somewhat below that of 1881, namely, 9·57 per cent. in 1882 against 10·6, the slight decrease being due to a restriction in the admissions from acute mania, from which the number fell from 99 in 1881 to 69. Of the admissions the cause of insanity was known only in 107 cases, and 66 of these resulted from the use of ganja; 42 of the latter recovered. Bengal.

The health of the asylums in 1882 was generally good. The daily average of lunatics in hospital, calculated on the mean population, was 3·58 per cent. against 4·01 in 1881, and the mean daily number of out-patients was 47 against 61. As regards the diseases under treatment there were more cases of anæmia and debility and diarrhœa compared with the numbers of the previous year, but there were fewer cases of fever and phthisis. Cholera was unusually prevalent in the asylums during the year, the cases numbering 15, while in 1881 the disease was entirely absent. The outbreaks were confined to the asylums at Dullunda, Dacca, and Patna, but the worst occurred at Dacca, where out of 8 cases 7 proved fatal. As stated above, the total deaths numbered 87, which were 3 in excess of 1881. Of these 12 resulted from cholera, 17 from phthisis, 11 from dysentery, and 9 from anæmia. Fatal diarrhœa was almost absent, as was also fatal fever.

In the European insane asylum at Bhowanipore 40 lunatics were under treatment during the year. Of these 4 were discharged as cured, 2 were deported to Europe under the Merchant Shipping Act, 3 were transferred to the care of friends, and 2 died, leaving 27 still in confinement at the close of the year. As usual the female ward was overcrowded, consequently the Government of India had been moved by the Local Government to consider the advisability of amending the law so as to admit of the more ready deportation of European lunatics to Europe.

The returns of the three lunatic asylums in the Madras Presidency for 1882–83 show a steady increase in the demand for asylum accommodation; but there was no overcrowding, the buildings being capable of accommodating 600, while the largest number in confinement at any one time during the year did not exceed 456. The year opened Madras.

with 397 lunatics in confinement, which was increased to 617 by 220 new admissions. Of the total number 66 were discharged as cured; 52 were transferred to the care of friends, mostly improved as regards their mental condition; 22 were otherwise discharged; and 43 died, so that 434 patients were under treatment at the close of the year. The cause of insanity in 148 of the new admissions is reported to have been due to physical and that of 61 to moral causes, by far the largest number coming under the heading "abuse of narcotic drugs."

Excepting at Madras, where during the months of July, August, and September there was an outbreak of scurvy, the health of the inmates of the asylum was particularly good. The highest death-rates were recorded at Madras and Calicut, namely, 97·6 and 156·8 per 1,000 respectively of average strength against 60·1 and 83 in 1881; in the Waltair asylum the mortality was exceptionally low, only 24·8 per 1,000 against 34·5, the decrease being attributed chiefly to an improved dietary. The high death-rate in the Madras Asylum was ascribed to scorbutic diarrhœa resulting from the outbreak of scurvy. Many patients also were admitted into this asylum in a bad state of health, as was also the case in Calicut, where 9 of the 12 deaths occurred to patients shortly after their admission. The asylums were free from epidemic diseases, although in Calicut one lunatic was admitted with small-pox.

The number of criminal lunatics in confinement during the year was 116, of whom 43 were new admissions. At the close of the year the number had fallen to 87 by the discharge of 25 and the death of four others.

Bombay.

The Surgeon-General with the Government of Bombay, in his report on the working of the five lunatic asylums in the Presidency for 1882, complains of the want of accommodation experienced during the year in the Colaba, Dharwar, and Ahmedabad asylums. At the first of these the daily average number of inmates was 8·5 in excess of the accommodation, and at the other two patients were on several occasions refused admission. This state of things the Governor in Council hoped would be remedied when the new institution (for the construction of which provision had been made) at Ratnagiri was built. The total population of the asylums in 1882 was 931 against 903 in 1881. Among these there were 102 criminal lunatics, a less number by eight than in the previous year. There were 296 admissions during the year and eight re-admissions. In the course of the year 260 patients were discharged, 100 as cured, and 152 were transferred to their friends. Of the total number of lunatics the cause of insanity was known in 470 cases, and of these 395 were ascribed to physical and 75 to moral causes; 166 of the former were alleged to have resulted from the abuse of spirits or intoxicating drugs.

The health of the patients was generally satisfactory. The admissions to hospital numbered 363, of which 144 were cases of malarious fever, 45 of debility, 63 of dysentery and diarrhœa, and 6 of cholera. There were 52 deaths or one less than in 1881, the death-rate being 83 per 1,000 in both years; 15 of the deaths were from debility, 11 from diarrhœa, and 4 from cholera. All the cholera deaths occurred at Ahmedabad, where also all the six deaths from this disease in the previous year took place.

Punjab.

The statistics of the two lunatic asylums in the Punjab, namely, Lahore and Delhi, show that the total number of patients treated was 453, of whom 338 were confined in the former asylum and 115 in the latter, the new admissions numbering 98 and 41 respectively. Of the total 138 lunatics admitted, 12 belonged to the criminal class, and at the end of the year there were 42 of this class in confinement. The number of patients cured at the two asylums was 41, and 13 were transferred to their friends. There was considerably less sickness among the patients than in 1881, and the deaths fell from 46 or 115·9 per 1,000 of average strength to 33 or 98 per 1,000. The death-rate was highest at Delhi, 131 per 1,000 against 149·8 in 1881, that of Lahore being 87·7 against 146 per 1,000. The higher mortality at Delhi was due to a rather excessive prevalence of pneumonia, from which there were 9 cases and 4 deaths.

North-Western Provinces and Oudh.

Each year shows a steady increase in the asylum population of the North-Western Provinces and Oudh. At the commencement of 1882 there were 852 lunatics under treatment in the four asylums; and in the course of the year the number increased to 1,163 by the admission of 311 patients. Before the year closed 294 had been removed, of whom 150 were discharged as cured, 39 made over to friends, and 77 died. Out of the 311 admissions 116 were ascribed to physical and 20 to moral causes. It is reported that, as a rule, the population of the asylums, with the exception of criminal lunatics and a few violent insanes who cannot be restrained by their friends,

is composed of stray waifs of humanity who have wandered away from the locality in which they are known, and have been picked up by the police in a state of destitution by the wayside. This accounts for the large number of admissions of whose previous history absolutely no information can be obtained, and for a large proportion of the mortality. Of the four institutions the death-rate was highest at Lucknow, 146·4 against 75 per 1,000 in 1881, and lowest at Agra, viz., 37·3 against 94·4. At the other two asylums, Bareilly and Benares, the mortality was in the ratio of 81·1 and 116·7 per 1,000 respectively against 85·1 and 84·6 in the previous year. The comparatively high mortality at Benares and Lucknow was due in great part to deaths from cholera and epilepsy.

The total number of criminal lunatics under treatment during 1882 was 266, or four more than in 1881. Of these 21 were discharged against 41 in the previous year, and 5 died against 12.

Central Provinces.

The results of the working of the two asylums in the Central Provinces show that at Nagpore 125 patients were under treatment during 1882, or 3 less than in 1881, and that at Jubbulpore there were 155, or one more than the number of the previous year, together making a total of 280, of which 31 were new admissions and 5 were re-admissions. The number discharged as cured or improved was 17, 5 were otherwise discharged, and 8 died, leaving 251 still under treatment at the close of the year. Of these 109 were located at Nagpore and 142 at Jubbulpore. Compared with the figures of 1881 there was a decrease of one in the former asylum and an increase of 18 in the latter, the increase at Jubbulpore being due to the fact that the number of deaths and discharges in 1882 were much smaller than in 1881. The sickness at Nagpore was considerably greater than at Jubbulpore, 114 cases against 58; but the mortality was the same, namely, 4 deaths in each asylum. In the previous year the amount of sickness was more nearly equal, while there were 9 deaths at Jubbulpore against 6 at Nagpore.

Berar.

At the Amraoti lunatic asylum in Berar there were 36 patients under treatment during 1882, 8 being new admissions. Before the close of the year 4 patients were discharged, 3 as cured. The accommodation of the asylum was taxed to its utmost, but in spite of the insufficiency of room the general health of the lunatics was better than in 1881, and there were no deaths. The Sanitary Commissioner attributes the satisfactory health of the patients to a good and sufficient dietary, and a plentiful supply of fresh vegetables. As usual, employment was found for the inmates on manufactures, in grinding grain, gardening, &c. "It must not be forgotten," that officer remarks, "that these industrial occupations are but curative remedies in the treatment of "the insane, the object being to draw them out of themselves and engage their attention "from the troubles which oppress them. It is often most difficult to get an insane "patient to follow even the slightest occupation, and it may be necessary for an "attendant to be constantly directing his movements for days together; but, once his "interest in the occupation is excited, the result will generally compensate for all the "trouble and perseverance bestowed upon him. If then these industries can be carried "on without loss, it is all we can look for, and they must be regarded chiefly as "forming part of a system of treatment, and not so much as a means by which to "increase the asylum receipts."

Assam.

The statistics of the Tezpur lunatic asylum, the only one in Assam, continued to be satisfactory. The year 1882 commenced with 55 patients on the rolls, and 22 more were admitted in the course of the year. It closed with 61, nine persons having been discharged as cured, one made over to friends, three escaped, and three died. The Surgeon-General testifies to the healthy aspect of the patients. It is reported that more was done during the year to employ the lunatics in healthy out-of-door work than hitherto; "they have been utilised in the reform of their barracks and stockades, but "have been chiefly engaged in gardening."

British Burma.

The number of lunatics confined in the Rangoon lunatic asylum during 1882 was 244, of whom 61 were new admissions and 8 were re-admissions. Before the end of the year 36 patients were discharged, and 19 had died. Of the 69 admitted in the course of the year the insanity of 12 was attributed to physical and that of 21 to moral causes, while nothing was known of the remaining 36 cases. The general health of the patients was more favourable than it had been for some time past. There was no epidemic disease,

and the daily average number of sick (3·64) was less than in any previous year since the asylum had been opened, while the deaths were 6 less than the number of 1881. No efforts were spared to keep the patients employed. As in former years, it was found that better results followed from the employment of the lunatics on useful labour in the open air than from any medicines or other forms of treatment. Although the accommodation was in excess of the maximum population, there was some overcrowding in the criminal section of the asylum. For increasing the accommodation of this class of lunatics an expenditure of 1,000*l.* had been sanctioned.

Medical Schools.

Bengal. All students at the Calcutta Medical College undergo a course of medical training for five years, though the Hospital Apprentices read for only three years in the College, their first two years being spent with a regiment.

The session of 1882 commenced with 117 students, but during its course the number was increasd to 228 by 111 admissions or re-admissions. At the end of the session 11 students passed their final M.B. or L.M.S. examination, 15 Hospital Apprentices passed and left for regimental duties, and 71 scholars and students ceased to attend, while two hospital apprentices were discharged, two resigned the service, and one died, thus leaving 126 students on the rolls, or 9 more than the session commenced with.

At each of the four vernacular schools of medicine there was an increase in the number of students, and on the whole the results of the examinations were satisfactory. The Campbell Medical School had, during the session of 1882, 170 students on its rolls, against 149 in the previous year, but the number which qualified for the diploma fell from 44 to 20. The results were more satisfactory at the Dacca School, where the number of students rose from 97 in 1881–82 to 119, and 16 out of 22 candidates passed the final diploma examination against 14 in the previous session. The Temple Medical School at Bankipore had 157 students on its rolls, two belonging to the military and the rest to the civil class. At the final diploma examination 26 out of 34 candidates passed, against 19 in the session of 1881–82. Students from the Central Provinces are now trained at this school, the Nagpore Medical School having been abolished. The number of students at the Cuttack School rose from 30 to 36, 12 of whom passed the diploma examination against five in the previous session. It is reported that this school is doing excellent work for the province of Orissa.

Madras. At the Madras Medical College there were 208 pupils on the rolls at the commencement of the session of 1882–83, of whom 88 were in the senior, 65 in the second, and 55 in the third or junior department. The progress made by the students was very satisfactory. In the senior department 26 pupils were qualifying for the M.B. degree, including one lady, and 62 for the Licentiate's degree, including two ladies. Seven candidates out of eight passed the preliminary scientific examination, and four out of five the first M.B. examination. Since the date of the College report the lady qualifying for the M.B. degree had passed the preliminary scientific examination. In the L.M.S. section, two out of three candidates passed the first examination, as also all the four who appeared for the final examination. Among the 65 students composing the second department, 21 were in their third or final year of study; of these 19 appeared for the final examination, and all but four qualified for the grade of Apothecary. Of 20 second-year students, including four female pupils, who appeared for the primary examination in this department, 12 qualified, including one lady. Favourable mention was made of the first year's students. In the Junior Department 14 pupils in their third year appeared for the final examination for the Hospital Assistant grade, when 10 passed. This department, it is reported, has since been closed, and the remaining pupils have been transferred to the Rayapuram Auxiliary School.

Bombay. The attendance at the Grant Medical College in Bombay was much greater in 1882 than in the previous year, viz., 343 against 283, and the pupils were very successful in obtaining degrees. Out of 62 competitors for the first L.M.S. degree of the Bombay University 32 passed,—4 in the first and 28 in the second division. In the final examination for this degree 15 students out of 30 passed, all being of the second class. Four Assistant Surgeons were examined, and all were found qualified for promotion. In the Hospital Apprentice class eight candidates passed the final examination, and favourable mention was made of the midwife class, consisting of seven women.

The Medical Schools at Poona, Ahmedabad, and Hyderabad were favourably reported on; the conduct of the students was good, and the results of the examinations satisfactory. There was an increased attendance at Poona and Hyderabad, but at Ahmedabad there was a falling-off, which is reported to have been due to the passing out of 31 students after completing their full course of three years. The Surgeon-General writes that the efficiency and popularity of these schools must be of growing importance to the Civil Medical Department, as it is only through them the subordinate establishment can be recruited.

Central Provinces.

After being opened for 15 years the Nagpore Medical School was, for reasons of economical and administrative expediency, finally closed at the end of March 1883. At the beginning of 1882–83 there were 36 students on the rolls, 13 being in their third year, 13 in their second year, and 10 selected probationers; but through resignations and other causes only 24 students continued their course till the end of the year. Of these, 12 were third year, 10 second year, and 2 first year students. All, with one exception, passed qualifying examinations, the first 12 as "Passed Medical Students," and have since been gazetted for duty; nine second-year students were found fit to commence their third year s course, and the two first-year students their second year's course of study. These eleven proceeded to the Temple Medical School at Patna to finish their studies. The Principal remarks: "If the young men of the second and first years continue as they "have begun, I am quite sure that they will, in the school to which they are about to "be sent, bring credit to the school they are now leaving." In future 10 candidates will be annually selected from the Central Provinces and sent to Patna to study medicine with the support of stipends furnished by the provincial administration, and with the prospect of succeeding by competition among themselves to vacancies in the staff of Hospital Assistants and Vaccinators.

VII.—SANITATION.

Bengal.

The sanitary condition of the town of Calcutta received much attention during 1882. The measures of improvement were numerous and important, and included the extension of the water supply, filtered and unfiltered, the completion of the sewerage system, the improvement of the privies of the town and of the arrangements for the removal of night-soil, the reclamation of bustees, and the obliteration of foul and dangerous tanks. The supply of filtered water was increased to a considerable degree during the year, and every effort was being made to give effect to the new scheme by which the supply would be raised from 8 million to 20 million gallons a day. In extending the drainage system 20·67 miles of sewer were laid down, and 3,053 new house connections were made. The total mileage of sewers actually laid down up to 31st March 1883 was 149·91 including 36·77 miles of brick sewers, and it is reported that only 15 miles of pipe sewers remained to be completed. The progress of the drainage works has been accompanied by the conversion of many filthy ditches into good roads or paths. For many years past the wretched state of the bustees in Calcutta had been strongly urged upon the Corporation. It is satisfactory to learn that more was done in improving them in 1882 than in any previous year, although the expenditure was not commensurate with the object to be attained. The work of tank-filling was not proceeding very rapidly, but the Lieutenant-Governor hoped that efforts would be made to secure greater progress.

At the Port, the condition of the Calcutta foreshore was further improved by the construction of suitable latrines and the posting of a police guard under Government orders. The state of the Howrah foreshore had been generally satisfactory; but the arrangements for removing nightsoil from a large latrine on the river bank within the premises of the East India Railway Company were considered to be very imperfect. It is reported that filtered hydrant water is now exclusively used by European crews, and that its value is also becoming more and more appreciated by the crews of native vessels.

Exclusive of Calcutta the municipal expenditure on sanitary works in Bengal for the year was 31 per cent. of an income of about 310,673*l.*, against 24 per cent. in the previous year, besides an expenditure of 18 per cent. on roads against 16 per cent. The increase was mainly due to the removal of police charges from the municipalities. It is reported that many municipalities failed to take full advantage of the increased resources placed at their disposal; while, on the other hand, in several an exceptionally large proportion of municipal income was devoted to sanitary works.

In the suburbs of Calcutta and in Howrah good work was done in reclaiming and improving bustees, and in promoting free perflation by means of regularly constructed lines and streets.

In several towns systematic drainage schemes were inaugurated, and either wholly or partially completed, and schemes previously commenced in others were continued, among them being the great drainage scheme of Lalbagh municipality in the Murshidabad district, which at the close of the year was almost completed.

Excellent work is reported to have been done in Maldah district, where roads were metalled, side drains cut, and jungle removed in many villages. Channels were excavated for the drainage and improvement of large tracts of country, for agricultural extension, for improving habitations, for providing water supply, for promoting communication by boat, and for increasing the volume of water in certain channels, whereby it was hoped to check malarious exhalations in their neighbourhood.

At Rungpore valuable results have been obtained from the drainage operations which have been carried out in the marshes round the town. This scheme, it is stated, was begun in 1877; and year by year, as the water-logged condition of the soil has been more and more removed, and the surrounding swamps have been reclaimed, the death-rate of the town has steadily diminished from 34·22 in 1878 to 23·64 per 1,000 in the year under notice.

Drainage improvements were also in progress in Nuddea, one of which was expected to improve a tract of country 20 miles long and a mile wide.

In Dacca a very commendable beginning has been made in filling up the "gors," the receptacles for generations of sewage, filth, and contents of privies which literally line their borders.

The town of Chittagong is said to have benefited much by the clearing of rank jungle in the neighbourhood, and by closer attention to surface cleansing and general conservancy. With the view of carrying out certain other schemes of improvement, a grant of 1,000*l.* has been made to this municipality. The question of a proper supply of water for the shipping of the Chittagong Port, stated to be one of the great wants of the place, was receiving the attention of Government.

A commencement was made with the Burdwan water-supply scheme, and considerable progress effected during the year.

The Howrah water-supply scheme was under consideration, and arrangements were being made for extending the Calcutta water-supply to the Suburbs and to Barrackpore. A scheme for the supply of filtered water to the town of Bhagulpore was taken in hand.

Very little sanitary work was performed by the vaccination establishment; but a set of rules have now been issued for the guidance of vaccination officers, and have already had the effect of causing more attention to be given to the sanitary condition of towns and villages in the interior during the camping season of 1882–83.

In accordance with a recommendation of the Army Sanitary Commission, the native floating population has been placed under inspection, for the discovery and treatment of diseases among them.

The year also witnessed the extension of sanitary clauses of a number of Bengal Acts to municipalities and other authorities, empowering them to deal more effectually with local disease causes.

In the Madras municipality useful sanitary work was done in the construction and maintenance of roads; several new latrines were constructed, and improvements were effected in the municipal markets, and in clearing away of parcherries. Good work was also done in conservancy at an expenditure of 24,669*l.* Progress was made in diverting foul drains which had hitherto emptied themselves into the Cooum. Arrangements have been made for diverting three large sewers to a pumping station in Napier Park; and a large sewer, which had formerly discharged its contents into the canal, was diverted to form a sewage farm at Theroopully Street. Madras.

The new drainage scheme of Black Town was commenced,—the large well at Rayapuram, where all the sewers are to converge, being first taken in hand; but great difficulty, it is stated, was experienced in carrying out this work, owing to the extraordinary abundance of fresh-water springs met with at no great depth below the surface.

Another important work was nearing completion, namely, the extension of the south main drain to the sea near the Fort, towards which the Madras Government had granted 1,366*l.* Valuable sanitary improvements were also effected in drainage in other parts of the city.

Extension of water-supply was carried out in certain divisions of the city, and the supply has since been extended to others,—a boon which is reported to be fully appreciated by the people. An ornamental fountain was erected in the vacant ground opposite the General Hospital, and the ground surrounding it has been converted into a garden or park for the use of the public. Water continues to be supplied from the Red Hills Lake; but, owing to the scanty rainfall in the first half of the year, the level of the lake was lower than it had been since the famine of 1877. A timely rainfall, however, in November of 25 inches raised the level of the lake by 10 feet. The water-works here appear to be sadly in want of a filtering system, as it is reported that fish and other deposits choke up the fountains and private service pipes, notwithstanding the large quantities washed out twice every week by the scour pipes.

No sanitary work of any magnitude was carried on in any other part of the Madras Presidency, but special attention appears to have been given to the important work of cleansing and repairing the sources of water-supply, also to drainage, conservancy, &c. On such work a sum of over 56,000*l.* was expended during the nine months ending December 1882, of which about 35,471*l.* were contributed by municipalities, excluding Madras, and 21,119*l.* by Local Fund circles. Several districts were visited by the Sanitary Commissioner during the year, and he reports very favourably on the progress made in sanitation in the various municipalities and small towns under Local Fund Boards. "This," he says, "is more marked in some districts than in others, and depends much on "the interest taken in such matters by Presidents and Vice-Presidents. But a public "feeling in this matter outside mere official circles has unquestionably arisen, and in my "tours I meet many intelligent native gentlemen giving a considerable portion of their "time and energies to municipal matters. In some districts, Madura and Bellary for

" example, sanitary associations have been started by the inhabitants of towns not " quite large enough to claim the honour of a municipality, and by this agency " improvements in drainage, scavengering, water-conservancy, and lighting are being " carried out. The movement is still in its infancy, but it is a movement in the right " direction, and will, no doubt, if fostered, in time develop into a most useful agency of " sanitation." He states further that he devoted much of his attention to the state of the water-supply of municipalities and towns, a question which, " simple as it looks on " paper, is a very difficult one to deal with." It is, however, satisfactory to learn that many municipalities " are bestirring themselves energetically in the question of a pure " water-supply, and that some, noticeably Negapatam, are apportioning a part of the " revenue to construct artesian wells."

Twenty-six fairs and festivals were held in the Madras Presidency between November 1882 and October 1883. The sanitary and other arrangements were on the whole satisfactory, and the general health of the people good. As usual cholera was a very unimportant element in the history of the fairs, the disease being present only at two—the Yakadasi festival at Sriringam and the Tirupati festival. At the former there were 4 cholera cases and 2 deaths, and at the latter 7 cases and 3 deaths.

Bombay.

The most important sanitary measure initiated in the Bombay municipality during the year was a scheme of surface drainage, the object being to raise the level of the Khetvadi district and drain it, and to provide two large intercepting drains to carry off the storm waters into a large reservoir to be built on the Flats. Most important sanitary results are expected from this scheme, and a great improvement in public health.

The drainage works and the reservoirs at Bhundarvada and the Malabar Hill were in progress. The main sewer from Carnac Bridge to Love Grove, which was completed in 1881, has since been connected with the old drain; the drainage has been diverted into the new main, and flows up to the pumping station at Love Grove. The first trials of the new machinery put up during the year were not satisfactory; but by March 1883 the difficulties were practically overcome, and since then the sewage has been pumped continuously into the sea with a most satisfactory abatement of a long-standing nuisance. The Queen's Road sewer, which is intended to intercept the drainage falling into Back Bay, and to convey it to the new system discharging at Love Grove, was begun, and is to cost 19,200*l.*, of which the Government contributes 5,000*l.* The drainage sewers in Kamathipura were also commenced and nearly finished, but the branch sewers remained to be completed.

As was the case in the previous year, the rainfall in 1882, both at Vehar and Tulsi, was considerably below the average, consequently there was a diminished supply of water in the lakes. An examination of the mains in these districts by the Waste-water Prevention establishment resulted in the discovery of much waste of water through leakage, the total quantity being 762,000 gallons a day. Much alarm was again caused by the impurity of the Tulsi water, which arose from the exhaustion of the supply in the lake, and the concentration of impurities in the water left for distribution. Filter beds were being placed in the Malabar Hill reservoir, but the work was not making very great progress.

In no other parts of the Presidency were there any very important sanitary works under construction. The total income of the various municipalities, exclusive of Bombay, was 291,943*l.*, and of this sum 72,228*l.* were expended on conservancy arrangements. Much good work was done in several municipalities in the construction of waterworks and drains, the erection and repair of latrines, besides a large amount of useful work of a minor character. Schemes for the better drainage of certain cities were also under consideration.

The expenditure from Local Funds on sanitation, amounting to 7,382*l.*, was for the most part confined to improvements in water-supply, chiefly in making new wells, and in repairing old wells, tanks, and aqueducts.

Punjab.

Very few sanitary works of any great magnitude were undertaken in the Punjab during the year, but much is reported to have been done in the way of minor improvements, adding to the comfort and also to the health of the people. Conservancy was more systematically carried out; streets were paved and provided with efficient side drains; and wells were cleared and kept in repair. A sum of 110,329*l.* (equal to nearly a third of their income) was expended by the municipalities on works of this nature, conservancy falling in for the largest share, viz., over 41,000*l.* Since the deplorable fever mortality in Amritsar in 1881, radical measures have been undertaken for the improvement of the sanitary condition of the city, including projects for a pure water-supply, and for intra-

and extra-mural drainage. A scheme of sewerage was in progress in Simla. The new water-supply to this station has proved a great boon to the inhabitants, but the supply having been found insufficient, the construction of a large reservoir at Sanjauli was sanctioned, and was being proceeded with. The scheme for a new water-supply for Delhi was still in abeyance. At Lahore the drainage works of the city were nearly completed; the sanitary condition of the town was also much improved by the metalling of the roads and the construction of new gutters, whereby sewage and storm waters find an easy exit.

In Peshawar good progress was made with the city canal, which was expected to be finished by the summer of 1883. At several other municipalities minor though important improvements were carried out. The use of town sewage as manure was rapidly increasing, and large sums were being realised by its sale. This the Army Sanitary Commission notice with satisfaction. "It is," they say, "a matter of great importance "that the practice should be extended, because, amongst other advantages, it facilitates "the immediate removal of household sewage from the houses and village sites."

A number of towns and villages were inspected during the year by the several Civil Surgeons in the course of their inspection tours; Vaccinators were being gradually utilised in aiding village sanitation, and much practical work was done in the direction of improving the sanitary condition of the province through the assistance rendered by district authorities in carrying out the suggestions of inspecting officers. It would appear that the most pressing need at present in connexion with village sanitation is the selection of suitable sites for depositing filth, a measure, it is stated, that is being impressed on village communities from time to time as occasion arises.

North-Western Provinces and Oudh.

The work of sanitary improvement continues to advance in the North-Western Provinces and Oudh. Much good work was done during the year in the construction of drains, improving the sources of water-supply, conservancy, clearing of drains, &c. One of the most important works was the erection of a reservoir for the supply of pure water to the townspeople of Almora in Kumaon district. At Allahabad a scheme for an artificial water-supply was under consideration, and an important outfall drain was in course of completion. At Shahjahanpur town new drains were constructed, a large number of filthy lanes in the most densely crowded parts of the town were paved and drained, and most of the cesspools were done away with. Plans and levels for the drainage of the city site of Bareilly were completed, and one of the main channels was nearly finished; a considerable amount of useful work of a minor character was also undertaken. At Lucknow the surface drainage was being extended and other improvements carried out; but the question of a pure water-supply was still under consideration. At Cawnpore drainage improvements were being pushed on. At Bulandshahr a masonry embankment for the reclamation of low ground near the river was completed; the drainage of the town was also remodelled by the levelling of certain mounds and filling up excavations. The amount spent on sanitary improvements in this town greatly exceeds that of any other, the average expenditure amounting to 37 per cent. of its income.

At all the other towns sanitary works of more or less importance were carried out, and it is satisfactory to learn that a general desire for sanitary improvement was everywhere being evinced.

Central Provinces.

Progress continues to be made in sanitary work in the Central Provinces. The chief event of the year was the completion of the waterworks at Jubbulpore, a work which has given great satisfaction, especially to the Chief Commissioner, who reported that the people seem to be taking gladly to the water brought to their doors. The Nagpore waterworks have also proved thoroughly successful. The example set by these two cities cannot fail, it is stated, to spread. More than 3,500*l.* were expended in the city of Nagpore on conservancy and sanitation generally. At Kamptee water-supply and drainage schemes were under consideration. The Hinganghat waterworks were nearly completed, and water has since been distributed. Satisfactory work was also done in Seoni and several other districts in improving the water-supply, and steps were taken with the view of securing more efficient work in village sanitation. Altogether 226 new wells were sunk in the province during the year and 54 were repaired.

Berar.

The total sum devoted to sanitary purposes in Berar during 1882 amounted to 14,182*l.*, of which 5,579*l.* were expended on conservancy alone. The most important works on hand were the waterworks of Khamgaon, the total cost of which will be about 17,000*l.*, and of Amraoti, at an estimated cost of about 27,000*l.* Steady progress is also being made with the drainage of the town of Khamgaon. This, the Sanitary Com-

missioner reports, is a most important work, and should greatly improve the health of the town. Improvements in the drainage of Akola were also made, and the town has been surveyed with the view of systematically carrying the drainage scheme to completion. A number of villages were inspected in the course of the year, when many of them were found in a very filthy condition, arising in a great measure from the stalling of cattle in them, and often inside houses, and from the manure heaps which were allowed to lie about polluting the air and fouling the water of the wells. The facts brought to light, the Army Sanitary Commission remark, "are quite sufficient to account for all the "epidemic severity with which the rural districts of Berar are visited, and they also "clearly indicate the sanitary measures required for protecting the lives of the people." During his inspections the Sanitary Commissioner displayed much energy and activity in endeavouring to inculcate rudimentary principles of sanitation among the villagers, and hopes are entertained that with the continued assistance of district officers some appreciable degree of progress may ultimately be achieved towards attaining a higher standard of cleanliness in the province.

Assam. Little was done during the year in Assam in the way of sanitary improvements, the chief drawback, as usual, being want of funds. The amount spent by the 13 municipalities on sanitary works was about 5,300*l.*, most of which was devoted to road-making and conservancy. The chief improvements were the introduction of a constant water-supply in the civil station of Shillong by iron pipes instead of by an open duct; the commencement of the waterworks at Gauhati for supplying the municipality with a purer water for domestic purposes; and the drainage works at Goalpara, with the view of draining the town area. At several other towns and stations sanitary improvements were being carried out. It must be remembered, as pointed out by the Chief Commissioner, that "the towns in Assam are poor and scantily peopled; they straggle over "large areas, covered with wretched temporary dwellings, and containing numerous "tanks and water-holes. While these exist, their water will be used, and to fill them "in is a work which could only be undertaken by making fresh excavations. "Altogether, it is not to be expected that sanitary progress in this province can be "rapid."

British Burma. The most important sanitary works in hand in British Burma during 1882 were the waterworks at Rangoon and those in connexion with the drainage and water-supply scheme at Prome. The former work was approaching completion, and a limited supply of water was furnished to the town. A scheme for supplying the town of Bassein with pure water was under consideration, and towards this work a provincial grant of 5,000*l.* has been promised. Considerable attention was devoted to sanitary improvements in the towns of Poungdeh and Mergui, and also in other towns, as far as funds permitted. In the course of the year 24 municipal committees were formed, and it is hoped that they may see their way to spending a fair share of the funds at their disposal in improving the sanitary condition of their towns. The Chief Commissioner, in his Resolution on the Sanitary Commissioner's Report, says: "It is difficult to effect much beyond the limits "of towns. Something may no doubt be done to improve the condition of outlying "villages by digging wells, constructing roads, and improving drainage; but it is in the "interior economy of the houses that reforms are chiefly required, and these reforms can "only be effected by the people themselves. The elements of sanitation are now "taught in all Government schools, and efforts are being made in various ways to extend "a greater interest in sanitation among the people generally."

Military.

Bengal. The amount spent on military works in the Bengal Presidency during 1882–83 was 531,306*l.* The work executed included many sanitary improvements in the arrangements of barracks, water-supply, and drainage of stations, &c. Among the more important projects on hand or completed during the year were the construction of permanent barracks at Lucknow, additional cantonments at Darjeeling, and the provision of additional hospital accommodation at several stations. At Rawal Pindi a combined hospital for native cavalry and infantry, to cost 6,415*l.*, was in progress, and a good portion was completed. At Umballa further progress was made with the water-supply project; and the important work of this kind at Peshawar was partially completed, the chief operation of the year being the distribution of water at an outlay of 4,093*l.* The water-supply scheme for Cherat was also completed. At Chakrata the water-supply was improved,

and schemes for supplying Allahabad, Delhi, and Meean Meer with water were under consideration. The drainage works at Lucknow were finished, at a total cost of 1,539*l.* Very little progress was made with the protective and drainage works at Nainee Tal, owing to the severity of the weather during the last six months of the year.

On the whole, sanitary matters appear to have been well attended to in the Madras command during the year. As regards drainage and sewerage, the barracks, hospitals, and buildings generally were kept in as good order as possible, and various improvements were carried out. Great attention was devoted to water-supply, and periodical analyses were made in the various cantonments of the waters in use for drinking purposes. "As a rule," the Surgeon-General says, "the sources of the water-supply are well "conserved; but in some stations where there are two sources, one used for 'drinking' "and the other for 'cooking,' it is difficult, if not altogether impossible, to prevent both "being used indiscriminately." In most stations occupied by European troops ample means of amusement and recreation were provided. The system of station hospitals, instead of regimental hospitals, was adopted from the 1st April 1882, and promises, it is stated, to work well, and to effect some pecuniary saving. New station hospitals were in contemplation for Kamptee, Rangoon, and Toungoo. Madras.

On military sanitary works in the Bombay command a sum of 11,904*l.* was expended during 1882. Of this sum 3,786*l.* were spent at Ahmedabad, chiefly in constructing a hospital for British troops. At Aden 1,475*l.* were expended on huts for infectious diseases, on improving the Sanitarium Hospital at Steamer Point, and on reconstructing a male ward and the female wards in the European Infantry Hospital in the Crater. At Poona 1,375*l.* were devoted to various sanitary improvements, chiefly in connexion with the Wanowri and Ghorpuri barracks and the Poona Army Veterinary School. At Mhow 1,272*l.* were spent on sundry sanitary arrangements, chiefly in the cavalry barracks and the European infantry lines. The change from the regimental to the station hospital system was working satisfactorily. Inspections were made by Deputy Surgeon-General Hewlett of the cantonments of Mhow, Neemuch, and Nusseerabad, and the defects brought to notice by that officer, together with his suggestions for improving the sanitary condition of these stations, were receiving the careful attention of the Government. Bombay.

INDIA OFFICE,
November 1884.

ABSTRACTS

OF

SANITARY AND OTHER REPORTS

FOR

1882.

ABSTRACT OF REPORT OF THE SANITARY COMMISSIONER WITH THE GOVERNMENT OF INDIA FOR 1882.

European Troops.

Sickness and mortality in 1882.

The health statistics of the European army of India, as a whole, during 1882 are most satisfactory. The ratios of admissions into hospital, of daily sick, and of deaths are all considerably lower than those of the preceding four years. In the following table the results are compared with those of each of these four years, and also with the averages of the ten-year period 1870–79. Compared with 1879, the admission-rate shows a reduction from 1,977 to 1,445, the daily sick-rate from 78 to 65, and the death-rate from 24·28 to 12·07.

Year.	Strength.	Ratio per 1,000 of Strength.				
		Admissions.	Daily sick.	Deaths.	Invaliding.	Total loss.
1870–79	577,416	1,475	60	19·34	43	62
1878	56,475	1,651	68	21·46	45	66
1879*	49,582	1,977	78	24·28	49†	73†
1880*	51,796	1,789	74	24·85	26†	51†
1881†	58,728	1,605	70	16·86	38	55
1882	57,269	1,445	65	12·07	33	45

* Excluding troops serving in Afghanistan. † Including troops in Afghanistan.

This last ratio is the lowest death-rate which has yet been recorded among the European troops of the three Presidencies taken together. The loss by invaliding during 1882 (33 per 1,000) was also less than usual. The total loss from death and invaliding combined (45 per 1,000) was thus considerably below the average, and much below what it has been in former years.

The average strength of the army of the Bengal Presidency (35,164) remained much the same as it was in 1881. The admission-rate, which had risen to a maximum of 2,108 in 1879, has been gradually falling, and during 1882 was 1,579—a ratio but little higher than the average ratio of the ten-year period. The daily sick-rate, 69 per 1,000, was smaller than it had been during the three previous years, but was still considerably higher than the average of the ten-year period. Although the mortality from cholera among the civil population in 1882 was considerably greater than it had been in 1881, the troops, both Native and European, suffered less from cholera than they did in 1881—a result which is no doubt to be explained by the fact that the area over which the disease chiefly prevailed is one where but few troops are located. The mortality from cholera was only 1·28 per mille, and the total mortality from all causes only 13·17. In no year except 1877, when it was at a minimum of 11·64, has the death-rate been so low as in 1882. During the ten years 1870–79, it averaged 21·00.

The average strength of the army in Madras (11,020) was somewhat greater than in 1881. The statistics show an improvement upon those of the preceding year, which was itself very favourable. The admission-rate and daily sick-rate in 1882 (1,058 and 57 per 1,000 respectively) were less than those of any of the previous four years and less than the average of the years 1870–79. Cholera gave rise to a slightly higher

mortality than in 1880, but the loss was trifling and amounted to only 0·82. The total mortality from all causes was only 10·25 per 1,000. During the last three years the death-rate has varied little, and it is worthy of notice that in all of them it has been under 11 per 1,000. For the ten years 1870–79, it averaged 17·69.

The strength of the Bombay army (11,085) in 1882 was considerably in excess of the average of past years. The European force quartered in Southern Afghanistan was furnished by Bombay, and they are included in the general results. The sanitary condition of the Bombay army, as a whole, was favourable. There was an improvement in the admission and daily sick-rates (1,405 and 61 per 1,000 respectively) as compared with the preceding years, though the daily sick-rate was still higher than the average of the ten years 1870–79. There was a marked reduction in the total mortality from all causes. The death-rate, which was 10·37, is the lowest on record and compares favourably with 15·27, the average of the ten years 1870–79.

An average strength of 929 men was quartered in Southern Afghanistan. If the statistics regarding them be separated from those of the Bombay army also, they are very favourable. The daily average sick among them was 65, the admission-rate 1,239, and the death-rate only 9·69. Nine deaths in all occurred, three of which were due to enteric fever. Fevers were little prevalent, but cases of diarrhœa and respiratory diseases were frequent.

The chief diseases causing admission into hospital in each of the three Presidencies are compared in the following table :—

Admissions from Chief Diseases per 1,000 *of strength*

Bengal.		Madras.		Bombay.	
1. Malarial fevers - -	660	1. Venereal diseases -	288	1. Malarial fevers -	558
2. Venereal diseases - -	271	2. Malarial fevers -	171	2. Venereal diseases -	224
3. Wounds and accidents -	111	3. Wounds and accidents	103	3. Wounds and accidents	109
4. Respiratory diseases -	80	4. Abscess and ulcer -	67	4. Respiratory diseases	84
5. Abscess and ulcer -	75	5. Dysentery - -	50	5. Abscess and ulcer -	72
6. Rheumatism - -	48	6. Respiratory diseases	47	6. Diarrhœa - -	54
7. Diarrhœa - - -	45	7. Rheumatism -	41	7. Rheumatism -	48
8. Hepatitis - - -	30	8. Diarrhœa - -	39	8. Hepatitis - -	22
9. Dysentery - -	27	9. Hepatitis - - -	36	9. Dysentery - -	14
TOTAL OF THE NINE -	1,347		842		1,185
TOTAL FROM ALL CAUSES -	1,579		1,038		1,405

In the Bengal and Bombay Presidencies malarial fevers gave rise to by far the largest number of admissions. In the Madras Presidency, as usual, the proportion of fever cases was comparatively small. It has steadily decreased since 1880. In 1880 the admission-rate under this head was 450, in 1881 it was 279, and in 1882 it was only 171. In the Madras Presidency the number of admissions for venereal diseases exceeds those for malarial fevers, whilst in Bengal and Bombay they follow second to fevers. Dysentery also in the Madras Presidency caused a larger proportion of admissions than in the other Presidencies. It will be observed from the above table that, whilst the order of the chief diseases causing admissions into hospital is almost the same for Bengal and Bombay, in Madras this order is disturbed chiefly by the greater frequency of dysentery and the diminution of respiratory diseases. Comparing the table with the one given in the Report for 1881, it will be observed that the admission-rate for malarial fevers was considerably smaller in all the three Presidencies, but most markedly so in the Bombay Presidency, where it fell from 841 per 1,000 in 1881 to 558 in 1882. The admission-rates for venereal diseases remained much the same as they were in 1881; only in the Madras Presidency was there an increase, and there it rose from 258 in 1881 to 288 in 1882. In every Presidency there was a reduction in the admissions from respiratory diseases. In Madras dysentery was more prevalent than in the previous year, and caused 50 cases per 1,000 as compared with 37 in 1881. In Bengal the rate was 27, and in Bombay 14.

In the following table the chief diseases which gave rise to mortality in the armies of the three Presidencies during 1882 are brought together, and, for convenience of comparison, the results of the two preceding years, as well as the average results of the 10 years, 1870–79, are placed side by side:—

Deaths from	Bengal.				Madras.				Bombay.			
	1882.	1881.*	1880.*	1870-79.	1882.	1881.	1880.	1870-79.	1882.	1881.*	1880	1870-79
Enteric Fever	2·90	2·62	3·07	2·28	2·09	0·58	1·36	1·42	1·90	2·83	5·76	1·75
Hepatitis	1·48	1·54	1·36	2·04	1·72	1·54	1·26	3·16	0·81	1·52	1·31	1·71
Cholera	1·28	3·23	4·84	4·18	0·82	1·73	0·10	1·68	0·63	0·30	—	1·53
Apoplexy	0·94	1·75	3·14	1·53	0·82	0·96	0·28	1·42	0·63	1·21	3·03	1·56
Dysentery	0·77	1·00	2·72	1·37	0·36	1·15	0·58	2·32	0·18	1·82	4·14	0·98
Remittent and Continued Fevers	0·74	0·70	2·34	1·74†	0·27	0·19	0·29	0·62†	0·54	0·91	2·78	1·12†
Total of these Diseases	8·11	10·94	17·47	13·14	6·08	6·15	4·37	10·62	4·69	8·59	16·97	8·67
All Causes	13·17	17·05	27·73	24·06	10·25	10·97	10·18	17·69	10·37	13·44	30·90	15·27

* Excluding troops in Afghanistan and on the march. † Include deaths from intermittent fever.

As has already been mentioned, the mortality from cholera in Bengal was considerably less than it had been in 1881. It will be seen that when compared with the average annual rate of the 10 years 1870–79, the result was more favourable still. The ratio, as usual, was higher in this Presidency than in either Madras or Bombay. Only in the Bombay Presidency did the mortality from this disease exceed that of the preceding year. With regard to enteric fever further particulars will be found in subsequent paragraphs; but it may here be mentioned that in all three Presidencies the mortality under this head exceeded the average mortality of the 10-year period, 1870–79. In all three it heads the list as the chief cause of death. In comparing the deaths ascribed to enteric fever in 1882 with the results of previous years, reference must at the same time be made to the deaths from other fevers, and the results must be considered together. The mortality from hepatitis during the year in every Presidency was under the average of the 10 years 1870–79, and only in the Madras Presidency did it exceed that of the preceding year. The highest ratio, 1·72 per 1,000, occurred in the Madras Presidency, and the lowest, 0·81, in Bombay. The death-rates from apoplexy compare favourably with the decennial averages in all Presidencies. Dysentery, although, as already stated, it was most prevalent in Madras, was more fatal in Bengal than in the other two Presidencies. The mortality from remittent and continued fevers was greatest in the Bengal Presidency and least in the Madras Presidency.

Of the several geographical groups into which the Bengal Presidency has been divided, it will be observed from the following table that the highest mortality occurred in the Gangetic Provinces with Oudh, and the lowest in the Hill stations, or, excluding Hill stations, in the Meerut and Rohilcund group:—

Period.	Ratio per 1,000 of strength.													
	Bengal Proper.		Gangetic Provinces and Oudh.		Meerut and Rohilcund.		Agra and Central India.		Punjab.		Hill Stations.		Bengal Presidency.	
	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.
1860–69	1,821	29·57	1,615	28·59	1,576	26·61	2,169	38·48	1,741	25·24	1,069	24·78	1,755	29·98
1870–79*	1,511	14·48	1,410	20·06	1,461	18·31	1,530	18·41	1,847	20·71	1,044	12·23	1,522†	21·00†
1880*	1,469	16·03	1,494	29·32	2,011	22·98	1,935	15·07	2,126	36·41	1,253	26·75	1,813	27·23
1881*	1,610	12·02	1,741	15·94	1,867	17·81	1,728	10·11	1,949	23·44	1,177	9·97	1,729	17·05
1882	1,187	11·19	1,699	22·61	1,513	8·86	1,891	10·51	1,796	12·12	975	8·65	1,579	13·17

* Excluding troops in Afghanistan and on the march. † Including troops in Afghanistan and on the march.

In the Gangetic Provinces and Oudh the rise in mortality from 15·94 per 1,000 in 1881 to 22·61 per 1,000 in 1882 was due mainly to the increase from cholera and enteric fever. Cholera prevailed very severely over the area which includes this group of stations, and the mortality from it among the European soldiers rose from 2·97 in 1881 to 5·58 in 1882. The mortality from enteric fever equalled 7·68 as compared with 2·70 in 1881. It occurred chiefly in the cantonments of Sitapur, Lucknow, and Cawnpore. In the remaining groups the death-rates were lower than the favourable rates of 1881,

with the exception of the Agra and Central India group, where the mortality was practically the same as in 1881. In the Meerut and Rohilcund group the reduction in the total death-rate from the comparatively low ratio of 17·81 in 1881 is very marked. This result is mainly due to a lessened mortality from cholera, enteric fever, respiratory and heart diseases. Among the troops in the Punjab also the reduction in the death-rate is very striking—from 23·44 in 1881 to 12·12 in 1882. This result is to be explained in great measure by the entire absence of cholera, which in 1881 caused a mortality of 7·00 per 1,000, and by a reduced mortality from enteric fever and apoplexy. In the Bengal Proper and Agra and Central India groups the mortality remained much the same as it was in 1881, the ratios of both years comparing favourably with the decennial averages given in the table. On comparing the admission-rates and death-rates in the several groups a remarkable disproportion will be observed. In the Meerut and Rohilcund group for every 182 admissions there was one fatal case, whilst in the Gangetic Provinces one death occurred out of every 75 admissions. In the remaining groups the number of admissions to every death was—in the Bengal group 106, in the Agra group 179, in the Punjab group 148, and in the Hill group 113. It would appear from this that the cases admitted into the hospitals of some of the groups were of a much more severe character than those which were admitted into others.

Of the 90 stations in the three Presidencies 73 had an average strength exceeding 200. Of these 73 stations, three, namely, Delhi, Amritsar, and Meean Meer, show an admission-rate above 3,000 per 1,000, and eight show a ratio exceeding 2,000, namely, Fyzabad, Fatehgarh, Morar, Mooltan, Peshawar, Neemuch, Baroda, and Kurrachee. In Delhi the admission-rate was 3,626, and of this ratio no less than 2,955 was due to fevers. In this station, with the exception of fevers and hepatitis, the admission-rates for all the other ailments which usually cause admissions into hospital were lower than they were in 1881. In Meean Meer the total admission-rate was 3,452 against 2,449 in 1881. Fevers, hepatitis, and respiratory diseases all caused more admissions than in 1881. Of the total admission-rate, 2,071 was due to fevers. From apoplexy, dysentery, and diarrhœa, the admissions were fewer than in 1881. In Amritsar, out of a total admission-rate of 3,190, 2,166 was due to fevers—a proportion much the same as it was in 1881. Dysentery, diarrhœa, hepatitis, and rheumatism gave rise to fewer admissions than in 1881, whilst the proportion furnished by venereal diseases, respiratory diseases, ophthalmia, and "all other causes" was higher.

Of the stations in the plains of the Bengal Presidency, where the average strength exceeded 200, the following recorded the highest death rates:—Sitapur, 66·86 per mile, Benares, 40·10, Fyzabad, 38·75, and Cawnpore, 20·96. All these stations, it will be observed, are situated in the Gangetic Provinces with Oudh; in 1881 the highest mortality was recorded in stations of the Punjab. Sitapur is a small station with an average strength of 344. As already noted, the chief cause of the mortality in this station was enteric fever. Though usually one of the most healthy in the Province, the mortality rose from 11·33 in 1881 to 66·86 per 1,000. The mortality in Benares rose from 31·40 in 1881 to 40·10. In this station deaths from cholera more than accounted for the increase as compared with the preceding year; excluding cholera, the death-rates were 25·06 in 1882, and 31·40 in 1881. In Fyzabad the total mortality in 1881 was only 6·12; in 1882 it was 38·75. The increase here also was mainly due to cholera. In 1881 only five deaths in all occurred in this station, of which one resulted from cholera and one from enteric fever; in 1882 31 deaths occurred, 20 of which were due to cholera, and three to enteric fever. In Cawnpore the excess in the death-rate over that of the previous year is accounted for by the increased mortality from enteric fever. During 1882, of the 20 deaths which occurred 12 were due to enteric fever, whilst in 1881, of eight deaths only one was attributed to this disease. The decreased mortality in the Punjab stations is very satisfactory. Jullunder, Amritsar, and Meean Meer, in 1881, recorded very high death-rates. These were ascribed mainly to the epidemic prevalence of cholera, but the results of 1882 compare most favourably with those of 1881 under other heads besides that of cholera. Excluding cholera altogether in Jullunder, the mortality during 1882 was 1·25 per 1,000, against 34·58 in 1881; in Amritsar it was 4·05 against 29·66; and in Meean Meer 13·56 against 26·71.

During the year 1882, 27·44 per cent. of the European army of the Bengal Presidency were located in Hill stations against 25·3 in 1881. The total admissions into hospital among troops in the Hill stations equalled 975 per 1,000 against 1,177 in 1881. The total death-rate also compares favourably with that of the preceding year, for it was only 8·65 against 9·97 per 1,000 in 1881. In 1881 three of the Hill stations recorded a mortality exceeding 10 per 1,000, namely, Solon, 10·26, Subathu,

13·92, and Bhagsu, 20·41; during 1882 only one, namely, Cherat, comes under the same category with a death-rate of 11·22. During 1882, of the nine Hill stations, five recorded a mortality under 5 per 1,000, whilst in 1881, in only two out of 10 stations was the result so favourable.

The statistics of the troops in Rajputana, Malwa, Sind, and Aden, continued favourable. The total admission-rate fell from 1,995 per 1,000 in 1881 to 1,745, but the death-rate increased from 11·90 to 12·37 per 1,000. The small increase in the death-rate is mainly due to cholera. The death-rate from this disease in 1881 was 0·40 per 1,000, whilst in 1882 it was 1·36. Of the 10 principal military stations included in this group, four recorded admission-rates exceeding 2,000 per 1,000, namely, Neemuch, Indore, Kurrachee, and Baroda. The largest of the stations in this group is Mhow, with an average strength of 1,350, and there the admission-rate was 1,602. The lowest admission-rate was recorded in Aden, namely, 964. The highest death-rates occurred in Indore, 29·70, where, however, the average strength was only 101, at Nusseerabad 23·63, and at Aden 20·49. The lowest death-rates occurred in Deesa (4·24), Hyderabad (5·56), Kurrachee with Ghizree (5·89), and Mhow (6·67). In Nusseerabad, out of a total of 16 deaths, five were due to cholera, and eight to enteric fever. In Aden 16 deaths occurred from various diseases. Eleven are recorded under eight different heads, and five took place out of hospital.

The average strength of the European troops quartered in the Deccan and Nagpur group was 7,685; among them the total admission-rate fell from 1,390 in 1881 to 1,029 during 1882, and the death-rate from 12·52 to 7·94. The reduced mortality during 1882 was mainly due to a diminished mortality from cholera, dysentery, and diarrhœa. In none of the stations comprised in this group did the admission-rate attain 2,000; the highest was 1,442 in Satara, where the average strength was only 138, and the lowest rate, 887, in Secunderabad, the largest station of the group, with an average strength of 2,558. The highest death-rates were recorded in Asirgarh, 24·59, a small station with an average strength of 122, and in Bombay, 14·16; the lowest in Ahmednagar, 2·10; and in Poona, with Kirkee, the ratio was only 2·85 per 1,000. In Secunderabad the death-rate was 9·38; of the 24 deaths recorded at this station seven occurred out of hospital, and six from enteric fever.

Among an average of 4,698 men composing the European force garrisoning the stations of Southern India, the admissions equalled 1,119 against 1,236 in 1881, and the death-rate 8·30 against 7·74. Whilst, therefore, the admission-rate was more favourable than in 1881, the death-rate was somewhat greater; enteric fever and heart diseases gave rise to a greater mortality than in 1881. The highest admission-rate in any of the seven stations of this group occurred in Bellary, 1,327 per 1,000, and the smallest in Calicut, 812 per 1,000; but Calicut is a very small station with an average strength of only 101 men. At Bangalore, by far the largest station of the group, the admission-rate was 1,166. The highest death-rates occurred at St. Thomas' Mount, 13·16 per 1,000, and at Bangalore 9·90. At St. Thomas' Mount there were in all five deaths, two from enteric fever, two from apoplexy, and one from hepatitis. At Bangalore, out of a total of 17 deaths, seven were due to enteric fever, and three to heart diseases.

The average strength of the European force in Burma and Pegu was 1,965. The total admission-rate was 1,047, compared with 1,122 in 1881, and the total death-rate 11·20 against 10·09 in 1881. The admission-rates were 1,194 in Toungoo and 1,122 in Rangoon. The rate for Rangoon is less, but that for Toungoo is greater than in the previous year. The death-rate in Rangoon was 15·60 per 1,000 against 10·48 in 1881, and in Toungoo 9·22 against 4·44. In Rangoon the increased mortality was mainly due to a larger number of deaths from hepatitis.

A comparatively small number of men were located in the Hill stations of the Madras and Bombay Presidencies. Their strength averaged only 718. Among these men the admission-rate was 1,348 against 1,168 in 1881, and the death-rate rose from 6·56 to 9·75 per 1,000. Enteric fever caused a larger death-rate than any other disease. There were two deaths from this cause in Wellington.

Cholera.

During the year there was a remarkable abeyance of cholera among the European troops. Throughout the whole army of India only 98 cases were admitted, or 1·7 per 1,000 of strength, and of these 61 died, yielding a death-rate of 1·07 per 1,000. The percentage of mortality among those treated was 62·24; in 1881 it was 68·84. Of the total of 98, 73 occurred in the army of the Bengal Presidency, and of these 45 died. In the army of Madras 15 cases occurred with nine deaths, and in that of Bombay 10 with seven deaths. In Bengal again, 61 of the 73 cases occurred in the Gangetic Provinces, and 40 of the 45 deaths. In this group the admission-rate from cholera was

8·5 and the death-rate 5·58. The largest number of cases occurring in any individual station of these provinces was 29 in Fyzabad, and of these 20 died. One of the cases occurred in June, and the remaining 28 during July and August. In Lucknow 12 cases occurred with eight deaths, and in Benares 11 with six deaths. In Bengal Proper only four cases occurred with one death. In the Meerut and Rohilcund group there was only one fatal case at Bareilly. Not a single case of cholera occurred among the troops in the Punjab, in the Hill stations, or in the Convalescent depôts.

Small-pox. During the year 44 cases of small-pox were admitted, or 0·8 per 1,000 of strength, and of these four died, giving a death-rate of 0·07 per 1,000 of strength, or 9·09 per cent. of those treated. These results are not so favourable as those of the preceding year, when only 17 cases with one death occurred. The largest proportion of cases occurred in the Bengal army, and all the deaths occurred in it. The death-rate from small-pox in the Bengal army (0·11) was almost identical with the average death-rate for the decade 1870–79 (0·12). Six cases occurred in the Madras army. In the Bombay army there was no case of small-pox during the year.

Fevers. For the whole army of India the admissions from intermittent fevers equalled 494 per 1,000, compared with 581 during the preceding year, or a reduction of 87 per 1,000. Intermittent fevers were most prevalent in the Bengal Presidency; there was a considerable reduction on the ratios of 1880 and 1881, but an increase compared with the annual means of the two 10-year periods. In the Madras and Bombay armies the admission-rate from these fevers was much under that of 1880 and 1881, and corresponds nearly with the average of the 10 years 1870–79.

Cases of remittent and continued fevers in the whole army of India fell from 87 in 1881 to 53 per 1,000 during 1882. The death-rate was much the same during both years (0·61 in 1882 and 0·65 in 1881), but the mortality per cent. of those treated was greater during 1882, the death-rate per cent. of those treated having been 1·16 against 0·74 in 1881. In all three Presidencies the prevalence of these fevers has been gradually declining.

Enteric fever. The admission-rate for enteric fever continued to rise. Throughout the whole army of India 357 cases were admitted, equal to 6·2 per 1,000, and of these 146 died, yielding a death-rate of 2·55. The admission-rate during 1881 was 5·6 per 1,000 and the death-rate 2·64 per 1,000. From the following table, showing the admission and death-rates from enteric and other fevers in the three Presidencies for a series of years, it will be observed that the disease was most commonly recorded in the Bengal Presidency :—

Period.	Bengal.						Madras.						Bombay.					
	Admissions per 1000.			Deaths per 1,000.			Admissions per 1,000.			Deaths per 1,000.			Admissions per 1,000.			Deaths per 1,000.		
	Enteric Fever.	Other Fevers.	Total.	Enteric Fever.	Other Fevers.	Total.	Enteric Fever.	Other Fevers.	Total.	Enteric Fever.	Other Fevers.	Total.	Enteric Fever.	Other Fevers.	Total.	Enteric Fever.	Other Fevers.	Total.
1870–79*	5·3	667·3	672·6	2·28	1·74	4·02	3·3	266·4	270·4	1·48	0·63	2·09	3·1	659·9	663·0	1·75	1·14	2·89
1880†	8·7	809·6	818·3	3·07	2·66	5·73	2·6	450·1	452·7	1·36	0·39	1·75	9·5	1,117·3	1,126·8	5·76	3·23	8·99
1881†	6·3	763·9	770·2	2·62	0·81	3·43	0·9	278·7	279·6	0·55	0·39	0·77	4·5	860·6	864·8	2·88	0·97	3·74
1882	7·3	660·0	667·3	2·90	0·77	3·67	4·0	171·5	175·5	2·09	0·27	2·36	5·1	553·5	563·6	1·90	0·81	2·71

* Including troops on active service and on the march. † Excluding troops in Afghanistan.

Next to Bengal enteric fever was most prevalent in Bombay.

An examination of the above table will show that no uniformity whatever exists in the relation between the prevalence of ordinary malarial fevers and the prevalence of the cases of fever which have been recorded as enteric. No such relation can be established for any year in any of the three Presidencies. Even in the average results of the 10-year period the variations in the three Presidencies are extreme. In the Bengal Presidency for every case of enteric fever admitted there were 115 cases of other fevers; in Madras for one case of enteric there were 68 cases of ordinary fevers, whilst in Bombay one case of enteric occurred for every 213 cases of other fevers. Discrepancies even more marked are observed on comparing the admission-rates for the two classes of fevers for individual years in the three Presidencies. For example, during the year under review, in the Madras Presidency, one case of enteric fever was admitted for every 43 cases of ordinary fevers, whilst during the preceding year the proportion was 1 to 322.

The mortality from enteric fever throughout the army of India during the year under review was 2·55 against 2·64 in 1881. There were 146 fatal cases in 1882 and 155 in

1881. The difference between the two years is thus very slight. In the monthly distribution of deaths also a remarkable similarity existed. In both years the largest number of deaths occurred during April, May, and June: in July there was a sudden diminution; a sudden rise took place in August, and another slight rise in November. The minimum was in February. The mortality was greatest in Bengal (2·90), and least in Bombay (1·90). The mortality in Madras, 2·09, however, differed but slightly from that of Bombay, exceeding it by 0·19 only. The mortality in Bengal exceeded that of the preceding year very slightly. In the following table, which gives a comparative statement of the death-rates from enteric fever and "other fevers," it will be seen that the highest death-rate from enteric fever in Bengal occurred during 1878, and that during the succeeding three years it fell gradually, a result no doubt influenced by the character of the different years:—

Presidencies.	Fevers.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	1880.	1881.*	1882.
Bengal	Intermittent, remittent, and continued.	2·25	1·78	1·89	1·10	1·18	0·71	0·66	1·59	2·63*	2·66*	0·81	0·77
	Enteric	1·71	1·62	1·53	2·01	1·59	1·75	1·55	4·69	3·86*	3·07*	2·62	2·90
	Total	3·96	3·40	2·92	3·11	2·77	2·46	2·21	6·28	6·49*	5·73*	3·43	3·67
Madras	Intermittent, remittent, and continued.	0·83	0·69	0·70	0·17	0·36	0·46	0·27	1·11	0·76	0·39	0·19	0·27
	Enteric	1·47	2·34	0·78	1·04	0·63	1·99	2·00	1·20	1·44	1·36	0·38	2·09
	Total	2·30	3·03	1·48	1·21	0·99	2·45	2·27	2·31	2·20	1·75	0·77	2·36
Bombay	Intermittent, remittent, and continued.	1·01	0·74	0·56	0·76	1·28	0·29	0·50	1·12	1·61	3·23	0·91	0·81
	Enteric	1·48	2·22	1·31	1·38	1·27	1·86	1·39	2·55	1·93	5·76	2·83	1·20
	Total	2·49	2·96	1·87	2·09	3·05	2·15	1·89	3·67	3·54	8·99	3·74	2·01

* Excluding troops in Afghanistan.

The mortality from enteric fever in Madras (2·09) was much higher than it had been in 1881 (0·58), and above that of every year since 1872. The nearest approach to it was 2·00 in 1877. In Bombay the mortality reached its maximum of 5·76 in 1880; in 1881 it fell to 2·83, and in 1882 it was only 1·90.

It has already been noted that no relationship seems to exist between the admission-rates from enteric and those from other fevers; but in the Annual Report for 1881 it was remarked, in continuation of what had been said on the same subject in former reports, that there is a remarkable correspondence between the fluctuations in the mortality from enteric and that from other continued fevers, so much so as to lead to the belief that the differential diagnosis between these classes of fevers is one of great uncertainty. Whenever the mortality from the one class of fevers rises to unusual proportions the mortality from the other class rises likewise. Any general rule, however, is difficult to establish, because of the difficulty of diagnosis, especially in the early stages of the fevers, and also because, as has been already pointed out in the case of Madras, departmental orders may alter the whole character of the returns, but two great general facts are clearly shown in the table given in the last paragraph, and they are of great practical importance. The first is that, although a new disease, enteric fever has been added to the nomenclature of Indian statistics since 1871, there has been no increase in the mortality of fevers, as a whole, since that time. If the figures for the earlier years be examined, it will be found that the mortality under the head of fevers has really been much reduced. The second great fact is that as the deaths ascribed to enteric fever have gone on increasing, those from other fevers have diminished.

For several years past the relation of enteric fever among European troops to their age and length of service in India has received much attention. In the subjoined table the composition of the army of India, as a whole, is given according to age since 1871:—

Year.	Under 25.	25 to 29.	30 and upwards.	
1871–75	38 per cent.	27 per cent.	35 per cent.	= 100
1876	33 „	33 „	34 „	= 100
1877	33 „	35 „	32 „	= 100
1878	35 „	36 „	29 „	= 100
1879	39 „	33 „	28 „	= 100
1880	41 „	34 „	25 „	= 100
1881	43 „	35 „	22 „	= 100
1882	41 „	36 „	23 „	= 100

It will be seen that the percentage of young soldiers under 25 years of age in the army during 1882 was slightly less than the percentage of 1881, and that there was a corresponding increase among the men of 25 to 29 years of age, and of 30 and upwards. The proportion in the army of men under 25 years of age is great. Omitting the averages for the period 1871–75, the percentage has risen from 33 in 1876 to 43 in 1881. Between the ages of 25 and 29 there is also an increase from 33 to 36 per cent. The increase in both these periods is made up by a decrease of more than 9 per cent. in the proportion of men above 30 years of age. In the following table a statement is given showing the death-rates per 1,000 at different ages, together with the percentages of liability at these times for the years since 1877:—

Statement showing the Death-ratios of the European Army from Enteric Fever at Different Ages, together with Ratios of Liability to it for 1877–82.

Year.	Mortality from Enteric Fever and Ratio of Liability to it at Different Ages.					
	Under 25.		25 to 29.		30 to 34.	
	Deaths per 1,000.	Percentage of liability.	Deaths per 1,000.	Percentage of liability.	Deaths per 1,000.	Percentage of liability.
1877	2·45	44·2	1·55	27·9	0·99	17·8
1878	6·04	53·0	3·55	31·1	1·04	9·1
1879	6·17	5·41	2·73	23·9	1·78	15·6
1880	6·25	56·26	3·15	28·35	1·09	9·81
1881	4·56	59·84	1·57	20·60	0·79	10·37
1882	4·32	56·18	1·55	20·16	0·78	10·14

The mortality among men under 25 years was 4·32 per 1,000, against 4·56 in 1881. Among men between 25 and 30 the rate was 1·55, and among those above 30 years only 0·78. All these ratios are smaller than those for the preceding year, but they represent almost the same relative percentage of liability. Among men under 25 years of age it will be seen that the death-rate was much higher than it was in 1877; among men between 25 and 30 years of age it was the same as in that year, and for men above 30 the ratio is the smallest of the series given.

No less important than age is the influence of length of residence in India in its relation to the disease. In the following statement the proportion of European soldiers throughout India who have served only two years, or less than two years, the proportion who have served five years and under, and the proportion who have served seven years and under, are shown for 1882 and the previous 11 years:—

Statement showing the Proportion of Men who have served in India two, five, and seven years from 1871 *to* 1882.

Period.	Percentage of Men to Total Strength who have served in India.			Period.	Percentage of Men to Total Strength who have served in India.		
	Two Years and under.	Five Years and under.	Seven Years and under.		Two Years and under.	Five Years and under.	Seven Years and under.
1871	36·2	64·6	78·9	1877	25·2	56·2	72·6
1872	33·7	66·7	80·0	1878	28·9	59·8	73·0
1873	31·7	65·5	79·6	1879	32·1	60·9	72·6
1874	25·9	64·3	79·8	1880	33·4	65·4	77·2
1875	26·1	60·1	81·0	1881	38·9	70·4	81·1
1876	25·5	57·6	75·1	1882	33·1	71·9	82·9

The proportion of men who had not been more than two years in the country is 33 per cent., or less by about 6 per cent. than it was in 1881. Of the total force nearly 72 per cent. had not been in India five years. The relative proportion of deaths from enteric fever during the different periods of residence, as indicated in the above statement, is given in the following table, and the results of 1882 compared with those of former years:—

Statement showing the Death-ratios of the European Army from Enteric Fever at different Periods of Residence in India, together with Ratios of Liability to it for 1877–82.

Year.	Mortality from Enteric Fever, and Ratio of Liability to it at different Periods of Residence in India.					
	1st and 2nd Years.		3rd to 6th Year.		7th to 10th Year.	
	Deaths per 1,000.	Percentage of liability.	Deaths per 1,000.	Percentage of liability.	Deaths per 1,000.	Percentage of liability.
1877	3·34	59·5	1·35	24·2	0·90	16·1
1878	7·90	63·4	2·64	21·2	1·38	11·0
1879	7·99	67·2	2·18	18·3	1·24	10·4
1880	9·68	75·98	1·78	14·30	0·47	3·98
1881	4·55	60·02	2·07	27·31	0·56	7·39
1882	4·68	61·10	1·93	25·19	0·34	4·44

The great liability to death from enteric fever to which young soldiers are exposed during the early years of their Indian service is a fact often noted in former years, to which attention is again prominently drawn.

The influence of climate in the production of enteric fever is also clearly shown by the monthly distribution of the disease. The facts are most distinct in the Bengal Presidency, where the differences in the temperature and other meteorological phenomena at different times of the year are most marked. In the following table the monthly distribution of this disease in the several geographical groups of the Bengal Presidency is given for the years 1870–1879, 1880, 1881, and 1882. It will be seen that the disease was more frequent in the hot weather than at other times. The maximum prevalence in the Gangetic Provinces with Oudh group occurred usually during April; in Bengal Proper,

Monthly Distribution of Admissions from Enteric Fever in 1870–79, 1880, 1881, *and* 1882.

Groups.	Period.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Bengal Proper	1870–79	2	6	5	1	4	2	3	4	7	2	1	2	39
	1880	—	1	—	—	—	—	—	—	—	—	—	—	1
	1881	—	—	—	—	7	2	3	1	—	—	—	—	13
	1882	—	1	—	2	—	—	—	—	—	1	1	1	6
		2	8	5	3	11	4	6	5	7	3	2	3	—
Gangetic Provinces	1870–79	38	25	22	72	74	44	33	43	55	26	19	35	486
	1880	2	2	2	15	6	5	3	2	8	12	4	2	63
	1881	1	—	10	10	9	6	—	5	—	5	10	5	61
	1882	2	5	17	22	26	12	1	16	8	2	8	2	121
		43	32	51	119	115	67	37	66	71	45	41	44	—
Rohilcund and Meerut.	1870–79	12	6	9	28	71	22	11	19	36	17	12	15	251
	1880	1	1	7	15	8	6	1	1	—	1	1	1	43
	1881	1	—	1	4	11	3	2	2	1	3	2	2	31
	1882	—	—	3	5	6	4	4	1	2	1	1	—	27
		14	7	20	52	96	34	18	13	39	22	16	18	—
Agra and Central India.	1870–79	8	6	10	20	14	3	4	13	46	32	15	8	179
	1880	1	1	2	—	—	1	—	2	—	3	6	—	16
	1881	2	1	2	3	7	—	2	3	7	3	3	1	33
	1882	—	—	1	2	3	—	—	9	6	1	—	—	22
		11	8	15	25	24	4	6	26	59	39	24	9	—
Punjab	1870–79	28	23	32	44	83	89	59	42	44	38	24	30	536
	1880	5	3	6	4	48	20	3	3	6	5	5	3	76
	1881	1	1	3	5	13	5	3	5	6	2	4	7	55
	1882	—	1	3	3	6	7	1	5	7	5	4	2	44
		34	28	44	56	110	121	66	60	63	50	37	42	—

and in Meerut and Rohilcund, in May, whilst in the Punjab it is as late as June. A noticeable feature in the monthly distribution of the disease is the renewed prevalence of the disease in September in every single group after the subsidence succeeding the prevalence at the beginning of the hot weather. This renewed prevalence of the disease at the end of the rains is especially marked in the Agra and Central India group, where indeed the maximum is then reached. The September increase is also well pronounced in the Gangetic Provinces and Oudh and Meerut and Rohilcund groups; but in these groups it does not nearly equal the prevalence in April and May. In the Punjab and Bengal Proper the September increase is but slightly marked:—(*See Table at bottom of p.* 55.)

Several medical officers refer to the difficulties attending the differential diagnosis of enteric fever from other fevers of a continuous nature, presumably malarious, and remark an extreme want of definition in the collective symptoms of enteric fever as rendering the separation of a case of this fever from the numerous other cases of so-called simple, continued, or remittent fevers extremely difficult. Thus, the medical officer in charge of the station hospital at Cawnpore, where a severe outbreak occurred, writes: "In "every fatal case of fever generally there has been a *post-mortem* examination. In "some the characteristic intestinal lesion, not suspected during life, has been brought to "light, and in others, when it has been suspected, it has been absent. The chief "difficulties in determining some of the cases of enteric fever have been the high "temperature on admission afterwards becoming remittent, the sudden seizure, and "absence of rose spots, diarrhœa, and abdominal symptoms, and the occurrence at the "same time of malarious fevers amongst men of the same regiment." Of the 18 cases which occurred in Cawnpore, mostly in A company of the Scotch Rifles, 11 were fatal. Of 10 of the cases which came from No. 2 Barrack, all but one occurred amongst men in the upper story. The duration of these cases was remarkably variable. Of the 11 fatal cases the duration in days was as follows:—10, 36, 39, 110, 26, 27, 17, 37, 58, 40, and 49: of those which recovered, 59, 65, 48, 105, 49, and 132 days. The remaining case required to complete the list of 18 cases was still in hospital at the time the report was submitted. Again, the medical officer in charge of the Station hospital, Lucknow, writes that of the 31 cases which occurred there, diarrhœa was present in 24, rose spots in 21, abdominal tenderness in six only. In regard to one case, another medical officer reports that "the symptoms of enteric fever were not well marked, and at the *post mortem* no "ulceration was found to exist in the small intestines or Peyer's patches." As to etiology, nothing has been added to our knowledge by the experience of the past year, notwithstanding the earnest efforts made to trace the origin of the disease. Surgeon-Major O'Brien, A.M.D., at Saugor, writes: "In six cases of undoubted enteric fever which I "have had under my care at this station during the present year (1882), I have, after "the most searching examination, utterly failed to trace the cause of any of them to "filth or fœcal contamination." Further on in his report, he writes that he would gladly substitute the name typho-malarial for enteric, "meaning a fever which, though not a "fœcal disease, is yet one that has all the ataxic symptoms of the true typhoid state, "intermingled with those of malarial fever."

Mere figures can take no notice of the difficulties and uncertainties of distinguishing one disease from another disease, or of the still greater difficulties and uncertainties of distinguishing one form of fever from another form of fever. All that statistics can show in regard to enteric fever is that up to the year 1871 no such disease appeared in the records of the European Military Hospitals in India, and that since 1871 it has taken a more and more prominent place, until, in fact, it has become the largest cause of mortality among European soldiers, and especially among the young European soldiers of the Army throughout India. Again and again has the important question recurred.—Is this a new disease, or is it the same disease as has been known for years in this country, but under a new name? So far as the statistics go there is very strong evidence to show that it is not a new disease. As has already been pointed out, the total death-rate from fevers, instead of increasing, as might be expected if a new and fatal form of fever had been added to the fevers which already existed, has decidedly decreased during recent years, as compared with that of former times. Taking the years since 1871, during which enteric fever has been entered separately in the hospital returns, there is no change in the net result; the mortality ascribed to enteric has certainly advanced, but the mortality ascribed to remittent and continued fevers has gone on decreasing, and the total mortality ascribed to all fevers taken together is much the same as before. This may be clearly seen from the figures which have been given in the first table which appears on page 53. In a few years it seems probable that remittent and continued fevers may almost, or even

altogether, disappear as a cause of death among European soldiers in India, and that yet the total mortality from fevers as a whole may remain as it was before. There is strong reason, therefore, to believe that under the name of enteric fever now appear a large proportion of those cases which used formerly to be recorded as remittent and continued fevers.

Bowel complaints.

Dysentery and diarrhœa diminished both in the number and severity of the cases. The admissions from dysentery for the whole European army of India equalled 28 compared with 32 in 1881 and 54 in 1880. The mortality per cent. of those treated fell from 5·48 in 1880 and 5·36 in 1881 to 2·01; and the death-rate per 1,000 of strength from 2·96 in 1880 and 1·72 in 1881 to 0·57. An equal reduction occurred in respect of diarrhœa also. The admission-rate was 46·1 against 56·5 in 1881 and 81·6 in 1880; the death-rate per cent. of those treated was 0·15 against 0·57 in 1881 and 1·60 in 1880; and the death-rate per 1,000 was 0·07 against 0·32 in 1881 and 1·31 in 1880. Dysentery was most prevalent in the Madras Presidency and least prevalent in Bombay. The admission-rate in the Madras Presidency (50) was nearly double that of Bengal (27), which occupies an intermediate position. Diarrhœa, on the contrary, was most prevalent in Bombay, where the admission-rate was 54, and least prevalent in Madras, the Bengal Presidency again occupying a place between the other two. A comparison of the results for the year under review with those of the decennial period 1870–79, shows that this order of presidencies according to the prevalence of dysentery is usual.

Apoplexy.

During 1881 the results under apoplexy were more than ordinarily favourable, and in 1882 they were more favourable still. For the army of India the admission-rate was 2·3 per 1,000 against 3·9 in 1881 and 6·7 in 1880, and the death-rate 0·85 against 1·48 and 2·69 in 1881 and 1880. Both admissions and deaths were most numerous in Bengal. In this Presidency the largest number of admissions occurred in the Gangetic Provinces with Oudh, where there were 32 cases with 10 deaths; most of them took place in June and August. In all three Presidencies the results were favourable, compared with those of other years.

Hepatitis.

In the army of India during the year 1882 the admissions and deaths due to hepatitis present no marked change. The admissions equalled 29·8 per 1,000 against 31·9 in 1881 and 31·0 in 1880, and the deaths 1·40 against 1·60 and 1·34. As usual, the largest proportion of admissions occurred in Madras.

Respiratory diseases.

In 1879, when a large portion of the army was exposed on active service, respiratory diseases were very prevalent. In that year the admissions under this head throughout the army of India equalled 91·8 per 1,000. Since then they have gradually fallen, and during the year 1882 were only 74·5, a ratio almost identical with that of the year 1878 in the end of which the Afghan campaign commenced. The death-rate from this cause, which rose to 2·93 in 1880, fell in 1881 to 1·76, and 0·75 during the year under review. In all three Presidencies both admission and death rates compare favourably with those of 1881. In Bengal and Madras the admission-rates (80 and 47 per 1,000 respectively) were less than the average rates for the decennial period, 1870–79, viz., 84 and 57; but in Bombay the rate (84) was still considerably higher than the average—a result due mainly to the prevalence of these diseases in that portion of the army which was quartered in Southern Afghanistan. In this force the admissions equalled 197 per 1,000. In the Punjab, which furnishes the next highest ratio, they equalled only 94·7, or less than half of the rate in Southern Afghanistan. In the Gangetic Provinces with Oudh, cases were nearly as numerous in proportion to the strength as in the Punjab.

Venereal diseases.

In the Report for 1881 it was shown, from the statistics of venereal diseases in the European army of India during a series of years, that the lock hospital system in the cantonments of this country has proved a failure. It was there noted that the admission-rate for these diseases in the army of India had been 260 per 1,000 during the year 1881, and that, with the single exception of 1878, this ratio exceeded that of any year since 1871. Another year's experience confirms the conclusion then arrived at. During 1882, cases of venereal disease were more common than they had been even in 1881, and equalled 265 per 1,000. This admission-rate, it will be observed from the following statement, exceeds the average ratio of the ten-year period, 1870-79, by 62 per 1,000.

Admissions from Venereal Disease in the Three Presidencies.

Presidency.	Admissions per 1,000.				
	1860–69.	1876–79.*	1880.	1881.	1882.
Bengal	265	209	276†	276†	271
Madras	‡	198	275	258	288
Bombay	‡	191	269	261†	224
India	—	203	250	260	265

* Including troops on active service and on the march. † Excluding troops in Afghanistan.
‡ The statistics of Madras and Bombay for these years are not available.

Looking at the results for the Presidencies separately, those of Madras during 1882 are the worst. The admission-rate here not only exceeded that of Bengal and Bombay, but greatly exceeded what it had been in the same Presidency during the preceding year. To this is mainly due the unfavourable results for the army as a whole, for in Bengal there was a slight improvement upon the two preceding years, and in Bombay the improvement was more pronounced. There still, however, remains the fact that, with the lock hospital system in continuous action, cases of venereal disease in all three Presidencies during 1882 were much more numerous than they had been in former years.

Invaliding.

Of the whole army of India 1,892 men were invalided, yielding a ratio of 33·08 per 1,000 of strength. This ratio is somewhat smaller than that of the preceding year, which was 38·36 per 1,000, and is still smaller than the average invaliding ratio of the years 1870–79, which is 43·04 per 1,000. The disproportionate distribution of invaliding in the several Presidencies noted in the Annual Sanitary Report for 1881 is still to be observed in the results of 1882, although the variations are not so extreme as they were in 1881. In Bengal the ratio of invaliding was 34·96 per 1,000 against 36·92 in 1881 and 41·40, the average ratio of the ten-year period, 1870–79. In Madras the ratio was the smallest, namely 24·12, against 27·91 in 1881 and 48·71 per 1,000, the decennial average. In Bombay the loss from invaliding was the highest, namely, 35·85, against 53·35 in 1881, and a decennial average of 42·79 per 1,000.

Of the 1,892 men invalided from the army of India during 1882, 985 were invalided for change, 694 for discharge from the service, and in the case of 213 it was not stated whether they were invalided for change or for discharge. Thus, 37 per cent. of the total number invalided are known to have been recommended for discharge. For 1881 the percentage was 35. In the Bengal army, of 1,237 men invalided 628 were recommended for change, 494 for discharge, and in the case of the remaining 115, the nature of the recommendation is not stated. The returns of invalids for 1882 are not so complete as usual, but measures are being taken to supply more full information for future years. In Madras 261 men were invalided, of whom 107 were for change and 99 for discharge. In Bombay, of 394 men 250 were recommended for change and 101, or 26 per cent., for discharge. Whilst the proportion invalided for discharge in the Bengal army was somewhat less that in 1881, it was greater in the other two Presidencies.

In all three Presidencies anæmia and general debility caused the largest amount of invaliding. The loss per 1,000 of strength under this head was, in Bengal 8·62, in Madras 3·42, and in Bombay 10·38. These ratios are all smaller than those of 1881, especially in Bombay, where in 1881 it was 17·88. In Bengal the following diseases gave rise to the next largest amount of invaliding: hepatitis to 3·82, phthisis to 2·91, and palpitation to 2·35 per 1,000. In Madras hepatitis gave rise to an invaliding ratio of 2·68, palpitation to 2·49, and organic diseases of the heart to 2·22 per 1,000. In Bombay the ratios were, for organic diseases of the heart 2·82, for hepatitis 2·37, and for phthisis 2·28 per 1,000.

For the army as a whole, 31·82 per cent. of those invalided were under 25 years of age as compared with 33·74 and 35·84 in 1881 and 1880. During these three years there has thus been a gradual reduction in the loss caused by invaliding among young soldiers. An increase, however, occurred in the ratios of men invalided between 25 and 30 years of age. The loss was 35·31 per cent. against 34·58 and 30·23 in 1881 and 1880. With reference to the effect of residence in the country upon invaliding, it

is shown that, whilst 17·35 per cent. of the total number of men invalided were under two years, 57·30 per cent. were between two and five years' residence. The proportionate number of men invalided from two to five years' service has risen greatly during the last three years, whilst the proportion of those whose service is under two years has diminished.

In the following table the health statistics of newly-arrived regiments are compared with those of the army generally:—

Experience of Newly-arrived Regiments in 1882.

	Average Strength.	Ratio per 1,000 of Strength.							
		Admission-rate.	Daily Sick-rate.	Death-rate.	Deaths from				
					Enteric Fever.	Other Fevers.	Apoplexy.	Dysentery and Diarrhœa.	Hepatitis.
Army generally	57,269	1,444·8	65·2	12·03	2·53	·68	·32	·64	1·43
New regiments	3,344	1,421·7	71·2	16·45	7·18	·60	·60	—	2·69

If these results are compared with the results of 1881 it will be seen that the differences between the two bodies of men were not so marked during 1882 as in the preceding year. The greatest differences in both years occur in the death-rates from enteric fever; but, whilst in 1881 the death-rate from this disease in newly-arrived regiments exceeded that in older regiments by 8·01 per 1,000, in 1882 the difference was only 4·65 per 1,000.

Sickness and mortality among women and children.

During the year there was a continued reduction in the average number of women and children belonging to European regiments of the army of India. The death-rate per 1,000 amongst women was considerably reduced, having been 19·78 per 1,000 of an average strength of 3,539, against 25·93 in 1881, and an average of 25·01 for the years 1870–79. The average number of children in regiments was 6,208, against an average of 11,162 during 1870–79. Among children the death-rate was 50·26 per 1,000, a more favourable ratio than usual, being 18·78 per 1,000 less than the average of 1870–79. Child-birth and abortion caused the largest proportion of the mortality among women (2·83), but this compares very favourably with the mortality under the same head in 1881 (4·54). The next highest death-rate was due to phthisis pulmonalis (2·55). Cholera gave rise to a mortality of 1·41, compared with 4·01 in 1881. Intermittent and continued fevers gave a death-rate of 1·69. The highest admission-rate (1,011) occurred in the Madras Presidency, but the mortality there was lowest. The total death-rate in that Presidency was 13·81, the largest proportion of which, 2·30, was contributed by apoplexy and sunstroke. During 1881 the total death-rate in this Presidency was 18·89. The smallest admission-rate, 799, with the highest death-rate (22·19), occurred in the Bombay Presidency. Of the total, phthisis pulmonalis contributed 4·76 and hepatitis 3·17. During 1881 the total death-rate in this Presidency was 24·60. In the Bengal Presidency the total death-rate was 21·57, against 29·30 in 1881. The largest proportion of deaths resulted from child-birth, namely, 3·93.

Meningitis, hydrocephalus, and diarrhœa caused greater mortality among the children in 1882 than in the year previous, whilst reduced mortality was recorded from measles, intermittent with continued fevers, anæmia and debility, bronchitis and pneumonia, and tabes mesenterica. Bombay recorded the highest mortality (62·44); Bengal stands next with a ratio of 50·89; and Madras last with a ratio of 39·79. Among the children of the army as a whole the largest proportion of the total mortality was due to diarrhœa, 10·79, against 8·09 in 1881. From diarrhœa the largest admission-rate occurred in Madras, but the highest mortality from this cause was in Bombay. Convulsions caused the next largest proportion of the total mortality, 8·38 against 9·77 in 1881. Bronchitis, with pneumonia, 4·67 per 1,000, and dentition, 4·51, come next in order. Small-pox caused a mortality of 0·16 against none during the preceding two years. Six cases of enteric fever are said to have occurred, but none of them proved fatal: 3 of them occurred in Bengal, and 3 in Madras. Twelve cases of cholera in all occurred, and of these 9, or 75 per cent., died. Four cases occurred in Bengal, all fatal; 4 in Madras, 3 of which were fatal; and 4 in Bombay, 2 being fatal.

Mortality of officers.

The total number of officers of the British and Indian services in the Bengal Presidency on the 1st July 1882 in India, or elsewhere, on furlough or sick leave, was 3,456; and among these 39 deaths occurred, of which 8 took place in India. The total death-rate, therefore, was 11·28 per 1,000, against 18·85 in 1881 and 21·96 in 1880. This total death-rate for 1882 compares favourably also with the death-rate for the soldiers of the European troops composing the army of the Bengal Presidency, which was 13·17 per 1,000. Taking the British and Indian services separately, the death-rate among officers of the British service was 11·02, whilst that among officers of the Indian service was 11·58. Of the total deaths, 4 resulted from cholera and 1 from enteric fever.

Native Troops.

Sickness and mortality among Native troops.

Among the Native troops throughout India both sickness and mortality were less than in any year since 1878, and considerably less than the average of the previous quinquennium, 1877–81. In many respects the results closely resemble those of 1877. The main facts are noted in the subjoined table. It may be explained that the figures in all the columns, except the last, refer to statistics of sickness and mortality occurring among men with their regiments. The weekly returns from which the annual tables are compiled refer to them only, but the last column includes also all the deaths which occurred among men when absent on leave or on medical certificate.

Year.	Average Strength.	Ratio per 1,000.				Mortality, including absent Deaths.
		Admissions into Hospital.	Daily Sick.	Deaths from		
				Cholera.	All Causes.	
1877–81	118,669	1,422	48	1·94	24·90	27·40
1877	113,966	1,030	32	1·53	10·90	13·38
1878	117,273	1,460	43	2·06	18·04	21·02
1879	121,107	1,735	58	4·61	35·15	37·79
1880	126,385	1,545	56	0·53	39·22	41·12
1881	114,612	1,305	46	0·97	19·24	22·62
1882	114,894	1,129	37	1·02	12·24	14·76

Among the chief diseases causing admission into hospital malarial fevers gave rise to the largest admission-rate, 553·5 per 1,000 of strength, against 641·6 per 1,000 during 1881. Enteric fever gave rise to the same ratio of admissions as in 1881—namely, 0·2 per 1,000; but the percentage of deaths occurring among those treated under this head rose from 55·0 in 1881 to 58·33 in 1882. With regard to the chief causes of mortality, respiratory diseases gave rise to the largest proportion of the total death-rate. The mortality from these diseases equalled 4·07 per 1,000 of strength, against 6·52 per 1,000 during 1881. The mortality from cholera was 1·02 per 1,000 of strength, a ratio somewhat higher than that of the preceding year. The total number of men admitted from cholera was 188, and of these no less than 117 died, yielding the high death-rate of 62·23 per cent. of those attacked.

Bengal army.

Among the men of the Bengal Native Army, the results for 1882 compare favourably with those of the preceding year, as may be seen in the following table:—

Year.	Average Strength.	Ratio per 1,000.				Mortality, including absent Deaths.
		Admissions into Hospital.	Daily Sick.	Deaths from		
				Cholera.	All Causes.	
1867–76	39,508	1,360	42	2·12	13·84	17·25
1877	39,649	1,097	34	0·35	10·32	13·63*
1878	41,116	1,645	49	2·09	22·59	25·57
1879*	31,116	2,023	68	2·80	31·78	53·61†
1880*	30,365	1,609	65	1·52	33·85	53·15†
1881*	36,896	1,495	51	0·92	19·76	27·73†
1882	40,256	1,250	41	0·72	13·34	16·49

* Excluding troops in Afghanistan.
† These ratios are calculated on the total regimental strength, including the army in Afghanistan.

Compared with the average results of the decennial period, 1867–76, it will be observed that, although the sickness, as estimated by the admission and daily sick rates, was still somewhat high, it had diminished and the mortality also was less. It is satisfactory to observe that the death-rates for every one of the chief diseases are smaller than those of the preceding year. The gradual diminution in the mortality from respiratory diseases during recent years which was noted in last Report continued. The death-rate among the troops in cantonments from these diseases fell from 7·21 in 1880 and 6·59 in 1881 to 4·50 in 1882. Although the total mortality from cholera (0·72) was small, yet the mortality per cent. of those attacked was higher than usual. In all there were 49 cases, and of these 29 were fatal, or a percentage of 59·18. Twenty-one cases of smallpox occurred, with five deaths, or at the rate of 23·81 per cent. Eleven cases of enteric fever were recorded against 6 in 1881, and of these 7 were fatal, or equivalent to a mortality of 63·64 per cent. of those treated. It may here be mentioned that throughout the Native Army of India *post-mortem* examinations were made in 9 out of 14 fatal cases, but that in only 2 of them were the lesions described at all characteristic of enteric fever. The well-known prejudice which exists among natives prevented a larger number of examinations being made.

The subjoined table shows the admission and death-rates among native soldiers serving in the five geographical divisions of the Bengal Presidency. It will be observed that the results of the year are, on the whole, favourable. Under every head they are an improvement on those of the preceding three years; only in the Gangetic Provinces did the mortality exceed the average of the ten-year period, 1867–76. The lowest mortality was recorded among the troops serving in Agra and Central India, and the highest by those in Bengal and Assam. The greatest decrease in the mortality of the year, as compared with the preceding year, occurred among the troops in the Punjab. The gradual and steady diminution in the death-rates among them since 1879 is very satisfactory.

Year.	Ratio per 1,000.									
	Bengal Proper and Assam.		Gangetic Provinces.		Rohilcund and Meerut.		Agra and Central India.		Punjab.	
	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.
1867–76 -	1,523	19·13	1,062	8·38	987	14·19	1,588	9·61	1,459	14·24
1877 -	1,492	19·64	768	5·19	642	9·52	906	7·44	1,243	8·85
1878 -	1,527	22·43	1,036	7·88	1,006	9·83	1,581	12·96	1,896	18·33
1879 -	1,316	25·57	1,656	11·05	2,033	36·17	2,303	16·07	2,173	47·64
1880 -	1,757	40·63	1,222	20·50	1,395	24·46	1,884	28·52	1,687	38·02
1881 -	1,772	22·53	1,260	15·78	1,373	15·67	1,380	9·35	1,521	22·86
1882 -	1,569	18·22	1,081	10·01	1,083	9·98	1,248	7·18	1,268	13·30

In all the five groups fevers, as usual, gave rise to the largest number of admissions. In all of them, however, the admission-rate for these diseases was smaller than in 1881. The marked prevalence of bowel complaints among the men serving in Bengal and Assam is shown in the following table, in which the admission-rates for other important diseases are also entered:—

Groups.	Ratio of Admissions per 1,000 of Strength.					
	Fevers.	Bowel Complaints.	Spleen Diseases.	Respiratory Diseases.	Rheumatism.	Abscess and Ulcer.
Lower Bengal and Assam - -	768	205	10	77	52	92
Gangetic Provinces - -	475	51	11	51	50	123
Rohilcund and Meerut - -	532	51	4	46	36	118
Agra and Central India - -	614	44	13	45	36	180
Punjab - - - -	669	67	10	76	40	120

It may be mentioned that in the Bengal, Assam, and Rohilcund with Meerut groups, bowel complaints existed to much the same extent as in 1881, but in the three other

groups they decreased in frequency. In all the groups there was a notable decrease in the admissions from spleen and from respiratory diseases as compared with 1881.

The chief causes of mortality in the several groups are shown in the accompanying table. In the Bengal and Assam cantonments the deaths from cholera were more numerous than they had been in 1881. Among the troops stationed in the Gangetic Provinces they were few. The disease was entirely absent from those of the remaining groups. The Bengal army, as a whole, thus enjoyed a marked immunity from cholera. Mortality from fevers also was less than in 1881 in every group, excepting that of Agra and Central India, where the increase, however, was trifling—1·74 per 1,000 against 1·25 per 1,000. The mortality from respiratory diseases was greatest in the Punjab; but even there it was little more than one-half what it had been in 1881—5·94, against 10·13 per 1,000.

Groups.	Ratio per 1,000.				
	Cholera.	Fevers.	Bowel Complaints.	Respiratory Diseases.	Total.
Lower Bengal and Assam - -	3·01	3·01	4·97	3·01	18·22
Gangetic Provinces - -	0·85	1·83	0·84	3·53	10·01
Rohilcund and Meerut - -	—	1·82	0·54	2·91	9·98
Agra and Central India - -	—	1·74	—	1·96	7·18
Punjab - - - -	—	2·11	1·34	5·94	13·30

As regards the admission-rates in individual stations, the highest were recorded in the following stations of the Punjab:—Murdan 2,370, Edwardesabad 2,297, Delhi 2,228, and Dera Ismail Khan 2,192. In all these stations fevers contributed mainly to swell the ratios, but in Murdan and Edwardesabad respiratory affections also gave rise to a large percentage of admissions. In addition to the above-named stations, the only others in the Bengal Presidency which gave admission-rates above 2,000 were Alipore with Baliganj (2,072) and Cachar (2,044), but in 15 others the ratio varied between 1,500 and 2,000.

As regards mortality in individual stations, in the regular army of Bengal the highest death-rates were recorded by the troops located in the following stations:—Alipore 31·25, Fyzabad 27·62, Mooltan 20·72, and Bhagalpur 20·18. At Alipore 31 deaths in all occurred, and of these 4 were due to cholera and 13 to bowel complaints. At Fyzabad 20 deaths occurred, and of these 6 were due to fevers, 4 to respiratory diseases, and 3 to cholera. At Mooltan no less than 18 of the total number of 23 deaths were due to respiratory diseases.

A very small force of the Bengal army was on service in Southern Afghanistan during the first three months of the year. The average strength was only 748. During the year 1881 a much larger force was quartered in this country, and the mortality among them was 106·30. During the time the smaller force remained there in 1882 the mortality continued very heavy, and amounted to 36·19 for that short period. Twenty-seven deaths in all occurred, and 15 of these (20·05 per 1,000) were from respiratory diseases. The largest number of admissions took place during January and the smallest during March.

In the Punjab Frontier Force the admission and daily sick rates were greater than in 1881, but the death-rate was less. The total mortality, indeed, both among men present with their regiments, and among all men, whether present or absent, was smaller than in any of the previous four years. The total number of deaths which occurred among men present with their regiments was 169, or 15·94 per 1,000; 93 of these, or 8·77 per 1,000 of strength, were due to respiratory diseases. Of the 93 deaths 55 occurred in Kohat and Edwardesabad with their outposts. In all 5 cases of enteric fever were admitted into hospital, and of these 2 proved fatal at Abbottabad. In one of them fairly characteristic lesions were found on *post-mortem* examination.

Favourable as were the statistics of Central India regiments during 1881, they are even more so for 1882. Both as regards sickness and mortality the results for 1882 compare very favourably with those of any of the preceding four years. The largest number of deaths resulted from respiratory diseases. The extraordinary prevalence of guinea-worm in this force is remarkable. In the whole Native Army of India, numbering an average strength of 114,894 men, 471 cases are recorded; and of these no less than 155 occurred in this small force, numbering an average strength of 5,119 men. The admissions occurred chiefly during the months of June, July, and August.

The health statistics of the Hyderabad Contingent are extremely favourable. With a daily average sick-rate of 21 there was the small death-rate of 3·12 per 1,000 among men present with their regiments. Twenty-two deaths occurred in the whole force, and 9 of these, or 1·28 of the total death-rate, were due to respiratory diseases. Here, also, guinea-worm caused a comparatively large number of admissions. There were in all 56 cases, most of them occurring during the months of March, April, and May.

The Madras troops, on the whole, were very healthy. Compared with the results of the preceding year, the admission and daily sick-rates show a reduction, whilst the death-rate among those present with their regiments remained almost the same. The mortality, including absentees, was less than it had been during any of the preceding four years, as shown in the following table:— Madras army.

Year.	Average Strength.	Ratio per 1,000.				Mortality, including absent Deaths.
		Admissions into Hospital.	Daily Sick.	Deaths from		
				Cholera.	All Causes.	
1877 - - -	28,304	861	28	2·79	11·80	14·36
1878 - - -	28,728	841	29	2·23	12·25	15·49
1879 - - -	27,314	1,269	43	3·19	18·89	21·23
1880 - - -	28,740	1,399	54	6·10	15·57	19·54
1881 - -	28,533	997	41	1·37	12·02	16·75
1882 - - -	27,654	879	30	2·64	12·01	14·99

Fevers gave rise to by far the largest number of admissions—a little more than two-fifths of the whole admission-rate. One fatal case of enteric fever was recorded at Secunderabad in June. One hundred and sixteen cases of cholera occurred, with 73 deaths, yielding the somewhat high death-rate of 62·93 per cent. of those attacked. Sixty-three of these admissions, or a little more than one-half of the whole, took place in March, and during that month 45 of them died. Forty cases of smallpox were admitted, and of these 2, or 5 per cent., died. Only 18 deaths were caused by dysentery and diarrhœa, against 42 in 1881. During the year twice as many deaths occurred from phthisis as in 1881, namely, 24 against 12.

The highest admission-rate recorded in any place occupied by Madras troops was 3,564 at Bhowanipatna and Kalahundi, and the figures embrace a period of only eight months. These troops were on active service, and were much exposed to the vicissitudes of the trying climate of those densely wooded hill tracts. No less than 2,888 of the admission-rate was due to fevers, and 196 to dysentery and diarrhœa. Among the larger stations occupied by Madras troops, Jubbulpore recorded an admission-rate of 1,064, mostly due to fevers; Hoshangabad 1,253, and Berhampore 1,711. The results for Burma compare favourably with those of 1881, the highest admission-rates having occurred in Thayetmyo 946, in Toungoo 848, and in Rangoon 843. In 1881 the highest rates were, for Rangoon 1,569, and for Shoaygheen 1,729. At Bangalore, the largest military station of the Madras Presidency, the admission-rate was 571 against 563 in 1881. In the Andamans and Nicobars the admission-rate was somewhat higher than it had been in 1881—1,672 against 1,417. No less than 69 of the total number of cholera cases recorded among the whole Madras army (116) occurred at Vellore in the 25th Native Infantry, and of these 48 died. All these cases, with the exception of 10, occurred during the month of March. Eleven cases occurred at Bellary in the 2nd Cavalry, with 3 deaths, and 10 at Trichinopoly, with 6 deaths. In Burma three cases were recorded: all of them occurred at Thayetmyo, and of these 2 died. The highest mortality recorded at any of the larger individual stations was 70·19 at Vellore during five months. As already explained, this large mortality was mainly due to a severe outbreak of cholera; for, of the total 51 deaths, 48 were due to this disease. The next highest death-rate is that for Rangoon, 27·80. In the Kalahundi district the death-rate was 26·72. Of the 19 deaths which occurred there, 7 were due to fevers, and 4 to dropsy. At Berhampore 9 deaths occurred, giving a ratio of 25·21. In all the other stations the death-rates were below 20 per 1,000.

The statistics of the Bombay army, taken as a whole, are favourable. A portion of this army was quartered in Southern Afghanistan during the year, and the statistics of this portion apart from those of the Bombay army, as a whole, are dealt with in the succeeding paragraph. The results given in this paragraph are for the whole Bombay Bombay army.

army, including the small force in Afghanistan. The admission-rate fell from 1,166 in 1881 to 1,067, and the total death-rate, including deaths among absentees, from 25·93 to 13·41. Throughout the whole army of the Presidency only 18 cases of cholera were recorded; of these 11 proved fatal. During the preceding year there had been 50 cases with 34 deaths. The cases were distributed as follows: in the Northern Division, 4 cases with 2 deaths; in the Konkan, 4 cases with 2 deaths; and in Khandeish and Deccan, 9 cases with 6 deaths. The one remaining case, a fatal one, occurred on the march. There were 25 cases of smallpox against 21 in 1881; only one of them proved fatal. Six cases of enteric fever were returned with 4 deaths. One hundred and fifty cases of guinea-worm were recorded against 265 in 1881. The largest number of these admissions took place in April and May.

Year.	Average Strength.	Ratio per 1,000.				Mortality, including absent Deaths.
		Admissions into Hospital.	Daily Sick.	Deaths from		
				Cholera.	All Causes.	
1877	23,388	1,074	33	1·93	10·90	12·96
1878	23,672	1,702	45	2·36	15·12	17·95
1879	22,854	1,663	51	3·11	20·22	21·90
1880*	15,328	1,283	45	—	10·44	56·53‡
1881*	18,349	1,166	41	1·85	14·01	25·93‡
1882†	23,772	1,067	36	0·46	12·96	13·41

* Excluding Afghanistan. † Including troops in Southern Afghanistan.
‡ These ratios are calculated on the total regimental strength, including the army in Afghanistan.

Of the several groups of stations occupied by the Bombay army the most unfavourable results are recorded in those of Southern Afghanistan. The average strength of this force was 3,771, and the admission-rate reached the high ratio of 2,146, or nearly twice the admission-rate of the Bombay army taken as a whole. The main causes of admission were—fevers, which accounted for nearly one-half of the whole; respiratory diseases, which accounted for 273; and dysentery for 110. Similarly, the death-rate in this force far exceeded the average rate for the whole army, having been 35·80. Of this death-rate, 22·01 was attributed to respiratory diseases. Of the 135 deaths registered from all causes, 83 were due to these diseases. Unsatisfactory, however, as the results are, they are an improvement on those of the preceding year, when the admission-rate was 2,317 and the death-rate 57·76. The largest number of admissions into hospital took place during the months of October, August, and September; but the largest number of deaths occurred during the months of January, February, and December.

The most favourable results in the Bombay army are shown by the troops serving in Khandeish and Deccan. Their average strength was 7,190. The admission-rate was 727, and the death-rate 6·26. The mortality among the troops serving in Aden and Sind was also small, having been 7·19. The largest number of these deaths was due to respiratory diseases. In the Northern Division the death-rate was 7·78. Here, also, the greatest number of deaths was caused by respiratory diseases. Lastly, the Konkan Division recorded a mortality of 11·17, due chiefly to fevers.

The greatest amount of sickness took place in the following cantonments, as shown by the admission-rate of 1,965 at Dwarka, 1,884 at Mehidpur, and 1,188 at Upper Sind. In all of them fevers mainly contributed to the results. The admission-rate for troops serving in the Persian Gulf fell from 2,457 in 1881 to 1,785 in 1882. The highest death-rate, 35·29, was recorded at Dwarka; but this is a small station, occupied during the year by an average strength of only 85 men, and the ratio is the equivalent of only 3 deaths. Sadra and Nusseerabad furnished the next highest death-rates. The former is a very small station, with an average strength of 67 men. In Nusseerabad 9 deaths in all occurred, 7 of them having been due to respiratory diseases. The mortality in Upper Sind was 12·80, against 23·85 in 1881. In 1881, three of the larger stations of the Presidency returned a mortality exceeding 20; during the year under review no single large station returned so high a rate. The highest mortality recorded at any large station was 14·29 at Nusseerabad.

The statistics of the force sent to Egypt, which consisted of troops from each of the three Presidencies, and numbered on an average 2,566 men, show that they enjoyed excellent health during the period of occupation (from the middle of August to the middle of

October). Only six deaths were recorded; four of these occurred in action, one as a later result of wounds received in action, and one from dysentery. The total mortality was only 2·34, the daily average sick 26·5, and the admission-rate 217·5. Dysentery caused the largest proportion of the admissions—66 per 1,000. Intermittent fevers, eye diseases, abscesses and ulcers, wounds and accidents, each caused about 30 admissions per 1,000.

For convenience of comparison, the main facts concerning the health of the various portions of the Native armies of the three Presidencies and of the subsidiary forces of India are brought together in the subjoined table. The extremely favourable results in the Hyderabad contingent are very striking. In the Central India and Rajputana regiments also they are very favourable. The Punjab frontier force suffered most from sickness, and the mortality in it was greatest.

Presidency.	Total Deaths per 1,000, including Absentees.	Average Strength present with Regiments.	Ratio per 1,000.			
			Admissions into Hospital.	Daily Sick.	Deaths from Cholera.	Deaths from all Causes.
Bengal Native army - -	16·49	49,256	1,250	41	0·72	13·34
Madras " " - -	14·99	27,654	829	30	2·64	12·01
Bombay " " - -	13·41	23,772	1,057	36	0·46	12·16
Central India and Rajputana regiments	10·58	5,119	697	23	0·39	9·96
Punjab frontier field force - -	18·89	10,605	1,992	60	—	15·94
Hyderabad contingent - -	4·47	7,061	630	21	0·29	3·12
India - - - -	14·76	114,894	1,129	37	1·02	12·24

Jails.

Taken as a whole the improvement in the health of the jail population, which commenced in 1880 and continued in 1881, was still more marked in 1882. A comparison of the results of the past year with those of the period 1877–81, which included the unhealthy famine years, shows that, while the admission-rate and sick-rate were but little changed, there was a decided reduction in the death-rate. The mortality which during 1878 rose to a maximum of 81·31 has steadily fallen, until in 1882 it stood at 39·96, or a little more than 3 per 1,000 in excess of the average of the five years which preceded the famine period. In the subjoined table the results of the two five-year periods are given, but, as averages do not always form a safe standard for comparison, the figures for 1880 and 1881 have also been added here and in other places, so that they may be compared with those of 1882:— Sickness and mortality in jails.

Year.	Average Strength.	Ratio per 1,000.			
		Admissions into Hospital.	Daily Sick.	Deaths from	
				Cholera.	Dysentery and Diarrhœa.	All Causes.
1872–76 - -	99,758	1,016	?	2·86	18·48	36·24
1877–81 - -	112,670	1,189	44·9	4·48	24·97	63·01
1882 - -	94,063	1,214	42·1	2·75	15·21	39·96
1881 - -	100,844	1,214	45	3·03	16·92	44·03
1880 - -	106,763	1,213	46	0·74	19·43	48·31

The average jail population, which in 1878 attained the maximum of 127,914, has steadily decreased since then, and in 1882 stood at 94,063. For the five years, 1872–76, it was 99,758. The restoration of the jail population to its former average indicates that the disturbing influence of the famine years on the statistics of the last few years has disappeared. According to the Census of 1881, the average number of prisoners confined daily in the jails of India during 1882 was equal to 4·6 per 10,000 of the population.

A reference to the above table shows that, although the mortality for the year compares very favourably with that of the five years preceding the famine period, the admissions into hospital exceeded the average of those years. The admission-rate per

1,000 was 1,214, a ratio identical with that of 1881, but exceeding that of the quinquennial period 1877–81, when it averaged 1,189. Although the admission-rate for 1882 was the same as it had been in 1881, the sick-rate fell from 45 to 42, and it may therefore be inferred that the type of sickness in 1882 was of a less severe character than in the year previous. The similarity of the proportion in which the principal forms of diseases contributed to the admissions in the two years is very remarkable, as may be seen from the following examples :—

Intermittent fever	-	-	in 1881 = 519,	in 1882 = 513
Remittent and continued fevers	-	,,	= 19,	,,	= 20
Dysentery	-	-	-	,,	= 91,	,,	= 94
Diarrhœa	-	-	-	,,	= 98,	,,	= 99
Respiratory diseases	-	-	,,	= 56,	,,	= 61
Anæmia and debility	-	-	,,	= 28,	,,	= 28

As may be seen from the tabular statement given above, the death-rate due to cholera in 1882 was a very little lower than the average death-rate from this cause during the five years preceding the famine period, 2·75 compared with 2·86, but considerably less than the ratio for the famine period itself, when it averaged 4·48. There was also a diminution in the mortality from dysentery and diarrhœa, the death-rate for which fell from 16·92 in 1881 to 15·21 in 1882. For the five-year famine period it stood at 24·97. Fevers also fell from 4·32 to 3·25. It is satisfactory thus to find that under all the main heads there was improvement in the death-rates of 1882 as compared with those of 1881.

The proportion which the average number of prisoners has borne to the general population is shown in the following table :—

Ratio of Prisoners per 10,000 of Population in each of the Three Presidencies for 1882, 1881, 1878, and 1872–76 compared.

Presidency.	Period.	General Population according to Census of 1881.	Prisoners. Average Number.	Proportion to 10,000 of Population.	Deaths per 1,000 of average Strength.
Bengal	1872–76	147,215,384	68,328	4·6	39·39
	1878		78,116	5·3	65·85
	1881		63,478	4·3	44·42
	1882		59,489	4·0	42·56
Madras	1872–76	31,170,631	9,607	3·1	32·37
	1878		21,315	6·8	125·92
	1881		10,332	3·3	41·91
	1882		8,752	2·8	42·62
Bombay	1872–76	16,454,414	8,011	4·9	26·61
	1878		13,139	8·0	118·27
	1881		9,910	6·0	41·88
	1882		8,845	5·4	33·35

It will be observed that in all three Presidencies there was a further decrease in the number of prisoners during 1882. The ratio per 10,000, which in Bengal stood at 5·3 in the famine year, 1878, declined to 4·0; in Madras it declined from 6·8 to 2·8, the smallest of all, and in Bombay from 8 to 5·4. The figures fully substantiate the generally accepted opinion that the number of prisoners in India is dependent in great measure on the general condition of the people as indicated by the price of food.

The jail mortality and sickness of the three Presidencies are compared in the following table :—

Presidency.	Average Strength.	Ratio per 1,000. Admissions into Hospital.	Daily Sick.	Deaths from Cholera.	Deaths from Dysentery and Diarrhœa.	Deaths from All Causes.
Bengal	59,489	1177·6	39·9	3·11	17·31	42·56
Madras	8,752	795·0	28·8	3·20	20·91	42·62
Bombay	8,845	842·7	26·3	1·13	7·46	33·35

It will be observed that, whilst the mortality was only 33·35 in the Bombay Presidency, it was 42·56 in Bengal, and much the same (42·62) in Madras. It is only in Madras that the death-rate was higher in 1882 than it had been in 1881. In all three Presidencies, however, the death-rates continued higher than they were for the quinquennial period, 1872–76. But it should be observed that the differencies between the death-rates of the various Presidencies for the year under review and these quinquennial averages vary considerably. The death-rate per 1,000 for Bengal exceeds the quinquennial average by only 3·17; Bombay exceeds it by 6·74, and Madras by 10·25. As regards sickness, Bengal heads the list with 1,178 admissions into hospital per 1,000, and a daily sick-rate of 40. In Madras the admissions equalled only 795, but the sick-rate (29) was higher than in Bombay, where it was only 26, but where the admissions equalled 843. The excess of sickness in the Bengal Presidency is thus very marked.

This excess is marked, not only when compared with the statistics of the other Presidencies, but also with the experience of previous years. It will be observed from the following statement that the admission-rate was higher in 1882 than in any year since 1879, and that it was even higher than the average of the famine period, 1877–81. The daily sick-rate in 1882 was identical with what it had been in that period. In spite of increased sickness the mortality considerably lessened, and equalled only 42·56, as compared with 44·42 in 1881, and 55·40, the average of the famine period.

Year.	Average Strength.	Ratio per 1,000.				
		Admissions.	Daily sick.	Deaths from		
				Cholera.	Dysentery and Diarrhœa.	All causes.
1877-81	69,149	1,145	40	3·90	22·32	55·40
1877	63,600	967	30	3·07	10·59	31·88
1878	78,116	1,182	41	5·34	28·27	65·85
1879	73,801	1,285	46	6·38	30·65	77·90
1880	66,751	1,108	40	1·00	21·51	51·12
1881	63,478	1,151	41	3·10	17·91	44·42
1882	59,489	1,178	40	3·11	17·31	42·56

Fevers, as usual, gave rise to the largest number of admissions. They were, indeed, more prevalent than they had been during the two preceding years, and the admission-rate exceeded the decennial average—

Statement showing the Chief Diseases which have caused Admissions into Hospital in Jails of Bengal Presidency from 1873 to 1882.

Number.	Diseases.	Admitted per 1,000 of Average Strength.									
		Decennial Average, 1873–82.	1882.	1881.	1880.	1879.	1878.	1877.	1876.	1875.	1874.	1873.
1	Fevers	488	541	528	458	660	556	371	457	398	445	450
2	Abscess and ulcer	116	123	127	133	114	113	122	115	99	107	110
3	Dysentery	112	117	105	116	129	137	98	104	96	101	110
4	Diarrhœa	103	108	106	117	112	107	94	86	90	96	108
5	Respiratory diseases	44	45	43	48	42	45	43	41	37	45	44
6	Wounds and accidents	41	39	40	37	45	43	48	39	43	44	43
7	Atrophy and anæmia	23	28	28	28	29	28	24	19	16	15	19
8	Venereal diseases	17	21	20	20	18	18	15	12	21	16	13
9	Rheumatism	17	16	15	15	15	16	21	17	16	19	17
10	Eye diseases	13	15	13	14	14	13	12	11	11	12	13
	Total of the Ten	973	1,053	1,030	986	1,166	1,076	848	901	827	900	927
*	Total from all Causes	1,091	1,178	1,151	1,108	1,285	1,182	967	1,017	943	1,028	1,043

In the above table 10 of the chief diseases causing admissions into hospital are given, nd, while it will be seen that considerable uniformity is maintained in the number of dmissions from these causes during the last 10 years, it will also be observed that no ess than eight of these causes have furnished somewhat higher rates of admission than usual.

In the subjoined table the chief causes of mortality are given; it forms a companion table to that given in the preceding para.—

Statement showing Diseases which have been the Chief Causes of the Mortality amongst Prisoners of the Bengal Presidency from 1873 to 1882.

Number.	Diseases.	Died per 1,000 of Average Strength.									
		Decennial Average, 1873-82.	1882.	1881.	1880.	1879.	1878.	1877.	1876.	1875.	1874.	1873.
1	Dysentery and diarrhœa	18·90	17·31	17·91	21·51	39·65	28·27	10·59	14·75	12·38	16·38	16·63
2	Respiratory diseases	7·12	7·26	7·62	9·38	9·58	8·82	5·41	5·45	5·01	6·02	7·00
3	Fevers	5·29	3·58	4·65	4·45	13·82	7·40	1·97	2·36	4·20	3·72	5·47
4	Cholera	3·46	3·11	3·10	1·00	6·38	5·34	3·07	4·24	2·35	2·48	2·97
5	Atrophy and anæmia	3·10	3·04	2·58	3·66	5·48	5·01	2·69	2·19	1·65	2·37	1·94
6	Phthisis pulmonalis	2·30	1·93	2·24	2·53	3·00	2·76	2·34	3·24	1·86	2·51	2·33
7	Dropsy	·80	0·88	·68	1·05	0·99	0·83	0·71	0·73	0·67	0·85	0·55
8	Wounds and accidents	·68	0·62	·55	·63	0·66	0·95	0·75	0·52	0·62	0·69	0·73
9	Apoplexy	·56	0·30	·58	·88	0·76	1·02	0·80	0·59	0·52	0·31	0·81
10	Spleen disease	·35	0·18	·22	·57	0·31	0·23	0·20	0·29	0·77	0·37	0·33
	Total of the Ten	42·91	38·22	40·13	45·66	71·53	60·63	28·55	34·36	30·03	35·70	38·76
	Total from all Causes	47·36	42·56	44·42	51·12	77·90	65·85	31·88	37·51	33·55	39·90	43·08

As usual, bowel complaints have given rise to by far the largest mortality. The mortality from these diseases has been decreasing since 1879, and in 1882 was somewhat below the decennial average. Only two of the ten causes enumerated gave rise to a higher mortality than the average decennial ratio, and in each of these two cases the excess was trivial. There was a satisfactory decrease in the fever mortality, and a not inconsiderable decrease in the death-rate from phthisis. The total death-rate from all causes fell from 44·42 in 1881 to 42·56 per 1,000. This last ratio compares favourably with that of any preceding year since 1878, and differs but little from the death-rates of the years 1873 and 1874. It is also less than the decennial average.

But any inferences which may be drawn from these general statistics of the Bengal Presidency as a whole must be corrected by a detailed examination of the results in the different groups into which the jails of the Presidency have been divided, and the great divergence in these results is exhibited in the following table:—

Statement showing Sickness and Mortality amongst the Prisoners of the Bengal Presidency (arranged into Groups in accordance with their Geographical Positions) for 1877–81 and 1882.

Groups.		Average Strength.	Ratio per 1,000.				
			Admissions into Hospital.	Daily Sick.	Deaths from		Difference between Average Mortality and Mortality of 1882.
					Cholera.	Dysentery and Diarrhœa.	All Causes.	
I.—Lower Bengal and Assam	1877-81	14,788	1,519	50	7·43	31·63	67·50	−7·55
	1882	13,327	1,693	54	8·25	25·44	59·95	
II.—Gangetic Provinces and Oudh	1877-81	22,769	695	25	3·21	13·98	33·29	+0·41
	1882	18,515	724	28	3·19	14·36	33·70	
III.—Central Provinces (excluding Jubbulpore and Saugor)	1877-81	3,002	983	36	11·39	26·11	69·88	+19·78
	1882	2,833	1,106	48	4·24	49·42	89·66	
IV.—Agra and Central India	1877-81	5,338	1,063	49	2·89	17·16	51·33	−23·41
	1882	4,513	763	28	0·89	6·65	27·92	
V.—Rohilcund and Meerut	1877-81	9,072	935	40	0·35	15·30	37·59	−12·13
	1882	7,187	1,007	38	0·00	7·65	25·46	
VI.—Punjab	1877-81	14,180	1,674	51	2·38	31·64	88·13	−46·50
	1882	13,115	1,546	45	0·00	15·25	41·63	

The admission-rate and daily sick-rate for the jails of Lower Bengal and Assam show a greater prevalence of sickness in them than in the jails of any of the other groups. The admission-rate equalled 1,693 and the sick-rate 54 per 1,000—rates which are not only high in themselves and higher than the rates of other provinces, but also high as compared with the same group in former years. During the year under review the sickness was indeed greater than in any year since 1877, and greater even than the high average for the quinquennial period 1877–81. The Punjab jails come next in order of sickness, showing an admission-rate somewhat higher than that of the preceding year, but still lower than its quinquennial average rate. Next in order of unhealthiness come the Central Provinces, with an admission-rate much higher than that of 1881 and higher than the quinquennial average rate. It will be seen from an examination of the table that of the six geographical sections it contains, four show a higher admission-rate for the year than the averages for the preceding five years. Comparing next the daily average sick-rates, which are perhaps more accurate indices of the health of the prisoners than the admissions into hospital, three of the six groups, namely, groups I., II., and III., give a ratio higher than the average. Compared with the preceding year, the Central Provinces alone show a higher daily sick-rate. The death-rate from cholera exceeded the average of the preceding five years only in the first group, and no deaths were due to this cause in the fifth and sixth groups.

With regard to the mortality arising from bowel complaints, the unusually high rate recorded in the Central Provinces is striking, and will be further considered in a later paragraph. Of the six groups three show higher mortality rates from this cause as compared with those of the preceding year, namely, groups II., III., and V. It is satisfactory to find that the Bengal and Punjab jails are not included in this list, and that, indeed, the mortality due to this cause in them was considerably below the average for the preceding five years. This is more especially the case with the Punjab jails, where the mortality fell to less than one-half of its quinquennial average.

While the mortality from all causes was smaller in the Bengal and Punjab jails than in 1881, it is worthy of notice that it was higher in every other group. But by comparing the death-rates of the several groups with their quinquennial averages, it will be observed that a higher rate prevailed only in two of the groups, viz., II. and III. The excess over the average in the case of the jails of the second group is small, but that in the case of the third group is very considerable. The difference between the death-rate of the year and the average death-rate for the last five years is particularly striking in the case of the Punjab jails, where there is a diminution of 46·59 per 1,000. There is also a very marked improvement in this respect in the Agra and Central India jails. The improvement in the Rohilcund and Meerut jails is represented by 12·13 per 1,000, and in the Bengal and Assam jails by 7·55 per 1,000.

When taken by themselves, the statistics of the jails of Lower Bengal are disappointing. In last year's Sanitary Report it was observed that the results in 1881 were more unfavourable than the results of 1880. It was hoped that the causes of the great sickness and mortality of 1878 and 1879 were passing away, but the statistics for the present year are even more unfavourable than those of 1881. The admission and daily sick rates per 1,000 exceed those for any year since 1877, whilst the death-rate from all causes (69·21) nearly equals that for 1878, and is almost identical with the very high average death-rate for the previous five years. Nor is the result to be accounted for by any excessive prevalence of cholera, for, excluding cholera in all the years, the death-rate from all other causes stands at 59·43 compared with 59·04, the ratio for 1878, and 60·33, the average ratio for the years 1877–81. As usual, the chief forms of sickness were fevers and bowel complaints. The admission-rate for fevers was somewhat less than it had been in 1881, but the death-rate from this cause was higher.

Year.	Average Strength.	Ratio per 1,000.			
		Admissions.	Daily Sick.	Deaths from Cholera.	Deaths from Dysentery and Diarrhœa.	Deaths from All Causes.
1877-81	17,517	1,487	43	9·24	32·94	70·05
1877	17,862	1,376	39	3·29	18·98	49·66
1878	17,718	1,291	43	11·85	31·60	70·89
1879	17,771	1,573	51	18·91	45·02	97·57
1880	17,313	1,569	53	1·69	33·74	64·04
1881	16,014	1,594	52	5·37	34·72	67·13
1882	15,330	1,642	54	9·78	32·10	69·21

Note.—The results here given for the years 1880 and 1881 differ somewhat from those given in the same table in former Annual Reports, in which the results were for Bengal and Assam combined. The corrected results now given are for Bengal alone.

The great sickness and mortality among the prisoners of Lower Bengal are even more strikingly illustrated if the statistics of individual jails be taken separately. In only 10 of the 46 jails did the admission-rate amount to less than 1,000. In 13 of them it exceeded 2,000. In the Moorshedabad jail it reached the maximum of 3,102. In five of the jails the daily sick-rate exceeded 100 per 1,000, and at Chumparun it

reached the maximum of 120. In 22 of the jails the mortality was over 70 per 1,000, in 10 of them it was over 100 per 1,000. In the Chumparun jail it reached to 184 per 1,000, and in the Mymensingh jail to 253 per 1,000.

These figures are all the more remarkable because very different results were anticipated. In the early part of the year when submitting his Report for 1881, the Inspector-General of Jails in Lower Bengal remarked that during the first three months of 1882 he had in the course of his inspection been "very much struck with the marked improvement in the health of prisoners." "I am glad to be able to report," he adds, "that with the exception of the Civil Surgeon of Beerbhoom all the officers who have "written on this subject have referred to the great improvement in the general health of "the prisoners since the new scale was introduced." The new diet which had been introduced in place of the Conference scale had been in operation since the end of March 1880. To the Conference scale, it will be remembered, were attributed the great sickness and mortality of 1879, but the Conference scale had been entirely set aside, and it was hoped that the health of the prisoners would show a very decided improvement. The increased sickness indicated by the returns is believed to be more apparent than real. Greater care has been taken by medical officers to admit into hospital any prisoners who, by loss of weight or other symptoms, manifested even a slight deterioration in health. The sick list has in consequence been larger than it otherwise would have been. But whatever share this increased care may have had in augmenting the numbers in hospital, the mortality could not have been affected by this cause, and, as has been already stated, the mortality, instead of diminishing, had somewhat risen over the high ratio of the year previous. It is of the highest importance to ascertain what has been the cause or causes of the increased unhealthiness of the Bengal jails during recent years, so that, if possible, they may be either remedied or removed altogether. The opinion that the sickness and mortality arose from the use of the Conference diet has been examined every year since it was first expressed, but every year's experience, as it has been gained, has shown more and more conclusively that this opinion was too hastily formed. It rested, indeed, on no basis except the supposed coincidence in point of time, but even this basis was in reality wanting, for the sickness and mortality had commenced to increase in a very marked degree before the Conference diet had been brought into use. And not only have they continued long after the Conference diet has been stopped, but they have gone on increasing. The experience of the Bombay jails has a very direct bearing on this important question of diet. The following remarks are taken from the report of the Inspector-General of that Presidency for 1882. "There has been for many years past, "before my time, a special diet scale for the jails in the city of Bombay, which has not "been altered. This is smaller in quantity and contains less nitrogen and carbon than "the Conference diet scale. I wish this to be particularly noted, as in all discussions "on jail diets no objection has been taken to this inferior scale. * *

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"If the mortality in our jails is due to a deficiency in diet owing to the introduction of "the Conference diet scale, how is it that there has been a minimum of deaths in "the first eight jails on the list where the Conference diet scale, or the inferior diet "scale of the house of correction, is the maximum, and where no extras have been "given?"*

It still remains to be decided what have been the real causes of the great sickness and mortality in the Bengal jails. This matter has engaged the attention of the local government, and a special committee was assembled to examine into the bearings of this question as exemplified in the jail at Chumparun, where, as already pointed out, the prisoners suffered in an extreme degree. Stated shortly, the conclusion they formed is that the unhealthy condition of the prisoners in this jail was due to the unhealthy condition of the people of the district from whom the prisoner class was drawn. And this would appear to be the view which is generally accepted in reference to the prison population of the whole country. "The Lieutenant-Governor," it is said in the Resolution on the Jail Report of Bengal for 1882, "believes that in the Report now before Govern-"ment there is abundant evidence to confirm the view that the unhealthiness of the "prisoners in the Bengal jails and the mortality amongst them, must mainly be attributed "in a very great degree to the unhealthiness of the country generally, rather than to any "defect in the jails themselves, or to the diet and treatment of the prisoners, or the work "upon which they are employed." The proposal to appoint a committee to deal with the whole of this important question has been deferred until the results of another year's administration are known.

* The mortality in those jails varied between 0 and a maximum of 13 per 1,000.

The favourable character of the statistics of the jails of the North-West Provinces and Oudh noticed in last year's report was preserved in 1882. The admission and daily sick rates were lower than they were last year, and the death-rate from all causes diminished from 41 per 1,000 in 1878 and 1879 to 23 in 1882. A continued decrease in the mortality from bowel complaints is also noticeable. The highest mortality occurred in the Orai (69·57), Gorakhpur (67·47), and Mirzapur (48·78) jails. The site of the Gorakhpur jail has been described as "unutterably bad" by the Inspector-General, and its water-supply bad, and it is therefore not surprising that more than one-half of the mortality was due to bowel complaints. The Orai jail has a comparatively small average strength (115), and of the eight deaths which occurred in it, four were due to causes in no way dependent on jail life. The admission-rate for the North-Western Provinces and Oudh was only 724, or less than half the ratio for Lower Bengal (1,642), and the daily sick-rate was only 29, compared with 54 in Bengal Proper. Still more marked is the contrast in respect of the death-rate, which was only 22·93 in the North-Western Provinces and Oudh, whereas in Lower Bengal it was 69·21. In many of the jails the sick and death-rates were both very low.

The improvement in the health of the prisoners of the Punjab, which was noticed in last year's Report, continued. The mortality was 41·63, or 23·52 per 1,000 less than it had been in the preceding year. The chief causes were bowel complaints, which gave rise to 15·25 per 1,000 of the total mortality, respiratory diseases which gave rise to 13·42 per 1,000, and fevers which gave rise to 5·41 per 1,000. Compared with the rates of 1881, a considerable improvement will be found to have taken place in the case of bowel complaints and fevers, and but little in the case of respiratory diseases. Of the 35 jails of this province, only seven show a higher death-rate than the average death-rate for the year. It is very satisfactory that the Rupar and Rawal Pindi jails, which in 1881 suffered so much, do not find a place among the seven jails in which the mortality was highest. The mortality in the Rupar jail has continued to fall from 104·17 in 1880 and 55·74 in 1881 to 32·94 per 1,000, and in the Rawal Pindi jail from 391·75 and 195·33 to 22·40 per 1,000. The highest death-rate of the year occurred in the Lahore Central jail, where it was 113·22 per 1,000 against 101·49 in 1880 and 157·33 in 1881. The improvement thus shown over last year's rate is, however, due to the absence of cholera; for, if the deaths due to cholera in 1881 be subtracted, the death-rates for the two years stand for 1881, 110·49, and for 1882, 113·22. Bowel complaints and respiratory diseases gave rise to the largest number of deaths in this jail. Bowel complaints alone contributed the large ratio of 66·33 per 1,000 or 51·08 per 1,000 in excess of the average for the province, and respiratory diseases contributed 20·95 per 1,000, or 7·53 above the average. It may be mentioned that the latter half of the year showed improved health among the prisoners of this jail, and that this improvement has continued during 1883. The Inspector-General of Jails in the Punjab is of opinion that in the early part of 1882 the prisoners in this jail were still suffering from the unhealthy influences of 1881.

The statistics of the jails in the Central Provinces, taken as a whole, are very unfavourable, and are the more disappointing when contrasted with those of the preceding year. The death-rate rose from 29·30 per 1,000 in 1881 to 71·05. More than one-half of this mortality was due to dysentery and diarrhœa, and of the 153 deaths which occurred from these diseases, no less than 128 took place in the Raipur and Nagpur jails. This result was attributed to the admission into these jails of a large number of prisoners from Kalahundi who are said to be "utterly unable to bear loss of freedom and separation from their families." These prisoners were admitted in a very bad state of health, and the mortality from bowel complaints occurred chiefly among them. At Raipur the death-rate equalled 205·56. The nearest approach to this was 88·00 among a small body of prisoners at Bilaspur. In some of the other jails the results were very satisfactory. At Jubbulpore the admission-rate was only 488, and the death-rate 33·14. At Saugor, although the admission-rate was high, the sickness was of a very mild type, and the mortality amounted to only 16·30 per 1,000.

The statistics of the jails of Berar are in every respect satisfactory; the death-rate has been reduced to the very low rate of 8·50 per 1,000, or nearly one-fourth of the average of the preceding five years. It is worthy of note that this is the only province the jails of which have returned no mortality from bowel diseases. Out of an average of 1,177 prisoners confined during the year, only 10 deaths occurred. In the two main jails of the province there was very little sickness. At Amraoti the admission-rate was only 297, and at Akola only 323; the daily sick-rate in the one was 13, and in the other

only 10 per 1,000. The mortality, which was 8·37 at Amraoti, was at the minimum of 3·89 at Akola.

Although the admission-rate in the jails of British Burma was 1,168 per 1,000, the mortality fell from 45·82 in 1881 to 27·81, a ratio nearly approaching the very favourable result of 1880. The high admission and daily sick rates considered in conjunction with the very favourable death-rate show that the ailments from which the prisoners suffered were generally of a trivial character. Taken individually, several of the jails show a very low death-rate. At Moulmein it equalled only 20·43, and at Rangoon only 14·65 per 1,000. Of the total mortality of 27·81 in the jails of this province, 3·41 was due to cholera. The disease was present in five of the jails, but it was only in Tavoy and Thayetmyo that it appeared in the form of a regular outbreak. At Tavoy, out of an average of 80 prisoners, 10 were seized and 7 died; at Thayetmyo 32 were seized and 21 died. In the large jail at Rangoon, the 11 cases recorded were spread over six different months.

In the jails of Assam, although the admissions equalled 1,735 and the daily sick 45 per 1,000, the death-rate was only 33·08, the lowest recorded since 1877. The mortality due to cholera was trifling, although the disease was prevalent in the country, and that from bowel complaints shows a satisfactory decrease. Although the admission-rate in all the jails of the province was high, the death-rate in several of them was low, especially in Sylhet, where it amounted to only 21·48.

The statistics of the Madras jails are almost identical with those of the preceding year, but there was a small increase both in the admission and death rates. Out of thirty jails only nine showed a higher mortality than in 1881. Among these, the Trichinopoly Central jail, with its ratio of 164·77 deaths per 1,000 is conspicuous, and this excessive ratio has contributed in a considerable degree to raise the general average of the Presidency. Excluding the statistics of this single jail, the death-rate for all the other jails together would be only 28·96 per 1,000. The excessive sickness in this jail has occupied the serious attention of the local authorities. Of the 145 deaths which occurred in it, no less than 116 resulted from dysentery and diarrhœa. The prevalence of bowel disorders creates a strong suspicion that the water may have had much to do with the sickness, for the water used by the male prisoners as shown by analysis was very impure, while the women who used a different and better water did not suffer. The medical officer of the jail failing to find any local condition to account for the unfortunate results, expresses an opinion that the sickness was introduced by prisoners from Tanjore. He believes that jail diarrhœa is communicated from the sick to the healthy, and says that a weakly man may easily become infected from a latrine in common use. This is, however, one of those theories which are very readily advanced, but which rest too often on little basis of fact.

The diminution in the sickness and mortality of the prisoners in the Bombay Presidency, noted in last year's Report, continued. It is satisfactory to observe a continued decrease in the mortality among the Gokak gang, the death-rate having fallen from 156·36 in 1880, and 112·80 in 1881 to 61·48 per 1,000. Nearly one-half of the total deaths which occurred among these prisoners are still attributable to dysentery and diarrhœa. Whilst in this extramural gang bowel disorders give rise to the highest mortality, in the Nara and Shikarpore gangs respiratory diseases gave rise to the largest number of deaths. The total admission-rate of 843, the daily sick-rate of 26, and the average death-rate of 33·35 under the continued use of the Conference scale of diet are particularly deserving of attention. The point has already been referred to in remarking on the great sickness and mortality in the Bengal jails. An examination of the statistics of individual jails in the Bombay Presidency show that in many of them the results were most favourable, and this fact has an important bearing on the whole diet question in relation to the recent very marked increase in the sickness and mortality among the prisoners in Lower Bengal.

The results of 1882 in the Andamans show a marked improvement over those of the three or four preceding years. The admission-rate was still very high, but the daily average sick-rate, and more especially the death-rate, show a decided diminution. The death-rate, indeed, differs but little from that of 1877, the year preceding the period of increased unhealthiness, which set in somewhat suddenly in 1878. As the causes giving rise to the sickness in these settlements have been fully discussed in last year's report, it is unnecessary to recapitulate them here. The following extract from the report of the Officiating Superintendent of Port Blair and the Nicobars for the official year 1881–82 shows what has actually been done in the way of improved arrangements:—

"Their main features in brief outline may thus be sketched.

"They provide (1) for the acclimatisation of newly-arrived convicts on the healthiest stations here for a period of one year; and to permit of Ross Island being available for this purpose, the transfer of 500 women to South Point. (2) For the division of convicts into two classes—A and B. Class A, men who appear to have good strong constitutions and to be fit for any ordinary labour and exposure. Class B, men who are of delicate constitutions and unfit for such labour and exposure. (3) For the suitable employment of these two classes—B, men on light in-door work generally; A, men on the exposed and severer forms of out-of-door labour. (4) For the stoppage of reclamation works, jungle-clearing, and drainage works during July, August, and September. (5) For a change in the scale of convict clothing. (6) For thorough drainage of the land in the immediate vicinity of convict barracks and villages. (7) For removal of chains from new convicts on arrival from India.

"As the measures thus sanctioned have only come as yet into very partial operation, I shall reserve any remarks I may have to make regarding them until we have had the benefit of a year's practical experience of their working.

"I may, however, be allowed to say that these measures are conceived on the lines I have already indicated in my remarks under causes of sickness, as being the only ones holding out a prospect of any real and permanent improvement in convict health generally, and if they are only faithfully and fairly carried out, I have no doubt of their ultimate success. At the same time I cannot too strongly express my opinion that any change for the better must of necessity be a gradual and a slow one."

General Population.

Census of 1881.

In this section of last Annual Report a tabular statement was given comparing the results of the census operations of 1881 with those of previous years. These results were taken from the *Gazette of India* of the 10th September 1881, but they were subsequently revised and several alterations made in them. The following table embodies these corrections, and gives in addition other statistical information which will be found useful in connection with the subjects treated of not only in this but also in other sections of this report :—

Province or State.		Area in square miles.	No. of Towns and Villages.	Population.			No. of Persons per Square Mile.	No. of Towns and Villages per 100 Miles.
				Males.	Females.	Total.		
Ajmere		2,711	739	248,844	211,878	460,722	170	27
Assam		46,341	22,408	2,503,703	2,377,723	4,881,426	105	48
Bengal		193,198	264,765	34,625,591	34,911,270	69,536,861	360	137
Berar		17,711	5,585	1,380,492	1,292,181	2,672,673	151	32
Bombay	British Territory	124,122	24,593	8,497,718	7,956,696	16,454,414	133	20
	Feudatory States	73,753	13,191	3,572,355	3,368,894	6,941,249	94	18
Burma		87,220	15,857	1,997,905	1,745,766	3,736,771	43	18
Central Provinces	British Territory	84,445	34,012	4,939,435	4,879,356	9,818,791	117	41
	Feudatory States	28,834	11,242	867,687	842,933	1,709,720	59	39
Coorg		1,583	503	100,439	77,863	178,302	113	32
Madras		141,001	52,648	15,421,048	15,749,588	31,170,631	221	37
North-Western Provinces	British Territory	106,111	105,421	22,912,556	21,195,313	44,107,869	416	99
	Feudatory States	5,125	3,322	384,699	357,051	741,750	145	65
Punjab	British Territory	106,632	34,324	10,210,053	8,640,384	18,850,437	177	32
	Feudatory States	35,817	18,546	2,112,303	1,749,380	3,861,683	108	52
Baroda		8,570	3,012	1,139,512	1,045,493	2,185,005	255	35
Central India		75,079	31,506	4,882,823	4,379,084	9,261,907	123	42
Cochin		1,361	655	301,815	298,463	600,278	441	48
Hyderabad		71,771	20,398	5,002,137	4,843,457	9,845,594	137	28
Mysore		24,723	17,655	2,085,842	2,100,345	4,186,188	169	71
Rajputana		129,756	30,901	5,543,665	4,723,727	10,266,892	79	23
Travancore		6,730	3,719	1,197,134	1,204,024	2,401,158	357	55
Total		1,372,583	714,707	129,941,851	123,949,976	253,891,827	185	52

Vital statistics.

The birth-rates for Bengal, North-Western Provinces and Oudh, Punjab, and Central Provinces were below those of 1881, and in some cases below the averages of the previous five years. These results are, however, partly due to the ratios of former years having been calculated on the population returns of previous censuses. The variations in the birth-rates for the various provinces are very great. Excluding the provinces of Mysore and Coorg, in which registration is still very backward, the lowest birth-rate, 22·07 per 1,000, was recorded in British Burma, and the highest, 42·0 per 1,000, in Berar. In Bengal, the birth-rate recorded is only 22·49 per 1,000. Compared with 1881, the death-rates were lower in the Punjab, the Central Provinces, and Bombay; in the North-Western Provinces and Oudh, Burma, and especially in Assam, they were higher. The mortality in the various provinces ranged from 16·2 per 1,000 in Madras to 33·67 per

1,000 in the North-Western Provinces and Oudh. The most satisfactory progress in registration was made in Assam, whilst in British Burma and Madras the results still showed great imperfections. In the following paragraphs the statistics of the births and deaths in each province are separately considered.

In Bengal Proper the total number of births registered in 45 municipalities and towns was 37,198, or less than the number registered in 1881 by 1,258. Of the 45 towns in which the registration of births was undertaken only 12 showed an increased birth-rate compared with 1881. The total birth-rate for the province was 22·49 per 1,000, but this number is a mean of results varying from 8·54 per 1,000 in Darjeeling and 9·82 in Barh to 43·79 in Jamalpur. The percentage of male to female births was 116. The variations in this respect ranged from 81 in Darjeeling and 97 in Rajshahye to 153 in Ranaghat. In only nine of the 45 towns in which births were registered did the number of births exceed the number of deaths. Deaths were registered in 45 districts, and in them the total number of deaths was 1,349,651, or an excess of 94,173 over the total of 1881. The chief cause of this enhanced mortality was an extensive and very fatal prevalence of cholera, and this mainly in rural circles. District officers, however, attribute a portion of the increase to improving registration. The total death-rate was 20·41 per 1,000, or an excess over that for 1881 of 1·42 per 1,000. According to sexes the male death-rate was 22·50 per 1,000, and the female 18·37. The proportion per cent. of male to female deaths was 120, or nearly the same as it had been in 1881. In 19 of the 45 districts an increased death-rate over that of the preceding year was recorded. The death-rates registered in the several districts varied from 7·01 per 1,000 in Darjeeling and 8·94 per 1,000 in Mymensingh to 45·69 in the Suburbs of Calcutta and 39·37 in Nuddea. The largest number of deaths from all causes occurred during November and December, but the largest mortality from cholera occurred during April, May, and June. The district mortality was 20·00 per 1,000, whilst the town mortality was 31·05 per 1,000. Cholera caused a larger mortality than usual, and the death-rate from fevers still continued high. Both the birth and death rates in Calcutta were below the average rates of the chief Bengal towns: the birth-rate in Calcutta was 17·32 against an average of 22·49 in mofussil towns, and the death-rate 30·41 against an average mofussil rate of 31·05. By comparing the death-rates from the chief causes of mortality in Calcutta with those in mofussil towns the following results are obtained: in Calcutta the mortality from cholera was greater than it was in the mofussil; from small-pox nearly ten times less, from fevers about half, and from bowel complaints almost the same. As contrasted with mofussil towns, above noted, the mortality in Calcutta is chiefly accounted for by the greater mortality from diseases coming under the head "Other Causes." In connection with this the Sanitary Commissioner remarks that these diseases appear to be considerably under-registered in mofussil towns. There was a considerable increase both of sickness and mortality during the year under review among the seamen of the port of Calcutta, both native and European, compared with 1881. The increase is chiefly traceable to cholera, the death-rate from which was very high.

The birth-rate for the North-Western Provinces and Oudh, which had steadily increased since the commencement of birth registration in 1879, fell, in 1882, below the rate of the preceding year, having been 37·54 per 1,000 against 40·34 in 1881. The birth-rates recorded in the several districts ranged between 22·42 per 1,000 for Dehra Dun and 53·03 in Lalitpur. In every district the male births exceeded the female, the average excess having been 12·18 per cent. The death-rate was 33·67 per 1,000, a ratio exceeding the mean of the preceding five years, which was 31·56. The death-rates varied from 20·56 in Kumaun to 59·63 in the Tarai. It is thus seen that the birth-rate exceeded the death-rate by 3·87 per 1,000 only against an excess in 1881 of 8·55 per 1,000. In 16 districts the death-rate was higher than the birth-rate. These 16 districts belong mainly to the Benares, Allahabad, and Rohilcund divisions. In 1881 the number of districts in which this occurred was five. During 1881 in every district except Partabgarh the proportion of male deaths exceeded the female deaths, but during the year 1882 no less than 14 of the 49 districts show a higher mortality among females than among males. This unusual excess is most marked in the Rohilcund and Agra divisions. In the Rohilcund division it occurs in five of the six districts, and in the Agra it occurs in four out of six. For the whole province, however, the deaths among males exceeded the deaths among females in the proportion of 115·12 to 100. The rural mortality was 33·15 and the town mortality 41·32 per 1,000. The rural mortality exceeded the average ratio for the preceding five years, whilst the urban mortality fell short of the average ratio. The highest death-rates recorded among towns were in Ajudhia (97·39), mainly due to fevers, and in Sambhal (73·41), the lowest in

Hardoi (18·25) and Muzaffarnagar (20·42). The highest mortality occurred during the months of September and October; the lowest during February and March. Cholera was more than ordinarily prevalent.

In the Punjab the birth-rate for the year fell somewhat below that of the preceding year, having been 36·65 against 39·79 per 1,000. The extreme variations range from 11·20 in Simla and 18·91 in Peshawar to 44·73 in Sialkot. The births of boys exceeded those of girls by 16 per cent., an excess identical with that of the preceding year. Of the 32 districts in which birth registration is carried out, four (Simla, Mooltan, Muzaffargarh, Dera Ghazi Khan) show a birth-rate smaller than the death-rate. In 1881 this occurred in only four districts (Simla, Kangra, Amritsar, Peshawar). The total death-rate from all causes was 27 per 1,000 against 30 in 1881. The death-rates varied from 16 per 1,000 in the Simla district to 45 per 1,000 in the Muzaffargarh district. The town mortality exceeded the rural mortality. The town mortality was 33 per 1,000 against 48 in 1881, and the rural mortality 26 per 1,000 against 28 in 1881. As usual, the mortality during the latter half of the year exceeded that of the former half. The province enjoyed an exceptional immunity from cholera. The mortality from fevers was also lower than it had been for any year since 1878.

The results of registration in the Central Provinces during 1882 show that the birth-rate fell below the ratio of the preceding year. The total birth-rate for the province was 41·73 per 1,000 against 48·94 in 1881. The extreme variations recorded range from 33·93 in the Burhanpur to 48·41 per 1,000 in the Saugor district. The male births exceeded the female by 7·69 per cent. against 8 in the two preceding years. In every district the male births exceeded the female births. The total death-rate was 29·98 per 1,000, a ratio considerably smaller than the mean death-rate for the previous five years, 33·21 per 1,000. The mortality arising from cholera, small-pox, and fevers was less than the average annual mortality from these diseases in the preceding five years. The extreme variations in the death-rates registered are 23·34 per 1,000 in the Burhanpur district and 43·34 in the Narsinghpur district. For every 100 deaths among females there were 113·92 deaths among males. The greatest mortality occurred during the months July, August, and September. The rural mortality was 30·17 per 1,000, a ratio but little less than the average mortality for the preceding five years. The urban mortality, 27·90 per 1,000, was considerably less than the average of the five years.

In the Report for 1881 it was noted that considerable progress had been effected in the registration of vital statistics in Berar, and the results of 1882 show further improvement. The total birth-rate was 42 per 1,000, varying only from 39·5 in the Wun to 45·0 per 1,000 in the Buldana district. The male births exceeded the female births in every district, the average excess having been 5·6 per cent. The birth-rates in every district also exceeded the death-rates, the excess varying from 7·7 per 1,000 in Akola to 17·4 per 1,000 in Basim. The rural birth-rate (42·2 per 1,000) exceeded the town birth-rate (35·3 per 1,000). The total death-rate recorded was 29·4 per 1,000. The extremes recorded were 23·7 per 1,000 in Basim to 33·9 per 1,000 in Akola. For every 100 females, 106 males were born, and 113 died. The highest mortality occurred during the months August and September. It varied from 1·5 per 1,000 in June to 4·2 per 1,000 in August. The death-rates for towns and districts were almost identical, viz., 29·7 and 29·3 per 1,000 respectively.

Registration in British Burma was still very imperfect. The Sanitary Commissioner observes, "Both the provincial birth and death rates would be nearer the truth if doubled." During 1882 the statistics for some hill tract areas and remote parts, which were quite untrustworthy, were excluded. Hence the population upon which the following ratios have been computed has been reduced from 3,692,263, the number in 1881, to 3,663,923. The average birth-rate was 22·07 per 1,000 for the whole province; but it varied from 15·49 in the Tharrawaddy district to 34·57 in Sandoway. In all districts the male births exceeded the female births. For every 100 females 107 males were born and 122 died. The average death-rate recorded for the province was only 16·14 per 1,000. The rates in the various districts ranged from 9·90 in Tharrawaddy to 20·27 in Tavoy. The birth-rate exceeded the death-rate by nearly 6 per 1,000. The highest mortality occurred during the latter half of the year, the number of deaths exceeding those of the first half by nearly one-third.

Very satisfactory progress continued to be made in the registration of vital statistics in Assam. A system of birth registration, which in 1880 embraced only eight towns, in 1882 included all the eight plain districts and two selected areas in the Khasi and Jaintia, and Garo Hills. In a number of town areas the registration of both births and deaths was made compulsory. As systematic registration in the plain districts of

Sylhet and Cachar and in the selected hill areas was not commenced till July of 1882, the comparison of the results in the two years 1881 and 1882 must be restricted to the six districts of the Brahmaputra Valley. In these districts the birth-rate was 26·34 against 19·20 per 1,000 in the preceding year. The extreme birth-rates recorded in the Brahmaputra Valley districts were 15·44 in Lakhimpur and 32·69 in Goalpara—a greater variation than any recorded during the preceding year. The total death-rate recorded for the whole province, including all the eight plain districts, was 25·35 against 16·04 in 1881. The extreme death-rates for these districts were 14·74 in Lakhimpur and 32·94 in Goalpara—a variation also greater than any of 1881. The actual numbers of births and deaths registered were, however, greater than those of the previous year. The death-rate for the Brahmaputra Valley districts separately was 28·53 per 1,000, and this ratio differs little from the birth-rate for the same districts above given, viz., 26·34. The number of males born to every 100 females was 106·19, whilst the number of males who died per cent. of females was 113·70. The mortality from cholera and fevers was very severe.

The vital statistics for the Madras Presidency still showed great imperfections. The birth-rate was 26·0 per 1,000 (as compared with 25·5 in 1881), varying from 15·2 in the Vizagapatam district to 43·2 in Madras. The excess of male over female births was almost identical with that of 1881, namely, 5·1 per cent.—a ratio slightly exceeding the English proportion. In every district the male births exceeded the female, but in Anantpur and Cuddapah the excess was nominal, viz., 0·2 and 0·6 per cent. The total average death-rate for the Presidency was 16·2 per 1,000, identical with that of last year and below the average for the preceding five years, which was 20·4 per 1,000. The death-rates in the several districts varied from 10·1 in Nellore to 34·8 in Madras. The birth-rate exceeded the death-rate by nearly 10 per 1,000—an excess somewhat greater than that of the preceding year. The highest mortality occurred during the months of January and December; the lowest during April, May, and June. The rural mortality was 15·9 per 1,000 against a mean of 20 for the preceding five years. It varied from 10·0 per 1,000 in Nellore to 23·5 in Tanjore. The town mortality was 23·3 per 1,000 against a mean of 26·5; but the variations in the records are extreme, ranging from 4·7 to 58·2. The death-rate from cholera (10·8 per 1,000) was greater than it had been during the previous three years, but that from fevers (6·5) was smaller.

Registration of births and deaths in the Bombay Presidency indicates continued progress, but certain imperfections are still apparent. There has been steady increase in the number of births registered from 22·85 per 1,000 in 1880, and 27·93 in 1881 to 29·86 in 1882. This last ratio, however, would seem to be but an approximation to the actual truth, for in the various districts the rates ranged between 10·51 and 41·06 per 1,000. The results of town birth statistics were still more variable, ranging from 6·61 in Dhulia to 43·68 in Kurrachee. In all districts the male births exceeded the female births, the average excess having been 8·7 per cent. The death-rate for the Presidency was 20·87 per 1,000, or 9 per 1,000 less than the birth-rate. The death-rates recorded varied from 9·90 in the Upper Sind Frontier to 26·16 in the Bombay City. The death-rates in all places, excepting the City of Bombay and the Hyderabad and Shikarpur districts, were lower than the birth-rates. In the last-mentioned district the excess in the death-rate is nominal. The diminished mortality of the year was mainly due to a smaller mortality from cholera, fevers, and bowel complaints.

In Coorg the birth-rate has been 15·69 per 1,000, a ratio almost identical with that of the preceding year. The male births exceeded the female births by 8·18 per cent., a larger excess than that of 1881, when it was 5·6 per cent. The death-rate was 17·46 per 1,000. It thus exceeded the birth-rate by 1·77 per 1,000, and was only about one-half the mean of the preceding five years. The statistics of this province are very variable. Fevers appear to have caused nearly three-fourths of the total mortality.

In Mysore the total birth-rate was 24·06 per 1,000, showing as mall excess over that of 1881, which was 23·70. The male birth-rate exceeded the female birth-rate by 6·06 per cent. Only in the Mysore district did the female birth-rate exceed the male. The death-rate was 16·93 per 1,000 against 21·46, the mean death-rate of the preceding five years. The rural mortality was 16·74, whilst the town mortality was 19·91 per 1,000.

Amongst natives in the cantonments of the Bengal Presidency and Hyderabad Assigned Districts, the mortality in Fort William during the preceding two years was the smallest recorded, and during the year under review there were no deaths. On the other hand, Amritsar in 1881 recorded the highest death-rate, namely, 93·82 per 1,000, but it recorded only 28·5 in 1882; among the larger cantonments Cawnpore and Alipore showed the highest rates, namely, 40·8 and 35·9 per 1,000 respectively.

Cholera.

During the year 1882 cholera was very prevalent over a great part of India, but the area which it occupied was not so extensive as it often has been in former years. A comparison of the map at the commencement of this volume with that in the report for the preceding year will show that, whilst in 1881 the epidemic reached far up the Gangetic Valley into the Punjab, during 1882 it stopped short on the confines of the North-Western Provinces. But, as the disease in 1882 prevailed more extensively in the Central Provinces, the area covered by it throughout India remained much the same as it had been in 1881. The mortality from cholera was greater than in any single year since 1877, and more than double that of 1881.

Province.	Population.§	Deaths from Cholera.							
		1874.	1875.	1876.	1877.	1878.	1879.	1880.	1881.	1882.
Bengal* - - -	66,106,026	56,876	109,988	196,590	155,305	95,192	136,363	39,643	79,180	182,352
Assam - - -	4,483,705	16,478	6,618	8,615	11,377	6,732	17,415	2,803	5,010	21,055
North-Western Provinces and Oudh - -	44,107,869	6,464	64,427	48,311	31,770	22,221	35,892	71,546	25,865	89,372
Punjab - - -	18,842,264	78	6,246	5,736	29	215	26,135	274	5,207	39
Central Provinces -	8,802,040	14	14,643	20,124	3,418	40,985	27,575	350	9,140	11,932
Berar - - -	2,630,018	2	22,465	2,683	842	34,306	223	1	3,404	3,573
Rajputana - -	‡	†	1,203	283	60	2,393	918	—	197	1,337
Central India - -	‡	†	2,555	1,929	926	8,047	2,734	298	581	1,562
Bombay - - -	16,454,414	37	47,573	32,117	57,228	46,743	6,937	684	16,694	7,904
Hyderabad - -	‡	†	10,891	5,582	7,414	6,696	6	—	1,721	150
Madras - - -	28,887,111	313	94,547	148,189	357,430	47,167	13,296	613	9,446	23,604
Mysore - - -	4,186,188	†	2,504	12,087	2,902	723	14	25	25	893
Coorg - - -	178,392	†	†	219	‡	49	—	—	3	31
British Burma - -	3,663,923	960	761	3,678	7,276	6,759	1,828	2,638	5,239	7,177

* Excluding Calcutta. † Statistics not available. ‡ Population not known.
§ According to census of 1881, except Madras, which is according to census of 1871.

Taking India as a whole the greatest number of deaths occurred during the months of April, May, and June, but the seasonal distribution of cholera in the different provinces varied remarkably. Thus, whilst in Bengal, Assam, Bombay, and Mysore the greatest mortality under this head occurred during May, in the North-Western Provinces and Oudh, Central Provinces, and Berar, the maximum was registered in August. In Burma the season of greatest cholera prevalence coincided more nearly with that of the central parts of India than with that of Bengal and Assam, the largest number of deaths having been recorded during July. In the Madras Presidency the largest number was recorded during the cold season, reaching its maximum in January. In the provinces of Bengal, Assam, the North-Western Provinces and Oudh the cholera mortality of 1882 was exceptionally high. The deaths in Bengal were more numerous than those of any year since 1874, with the single exception of 1876. In the two other provinces, the cholera deaths of 1882 were more numerous than in any of the years here tabulated.

In Bengal the disease prevailed with great severity and fatality. The mortality equalled 2·75 per 1,000 of population, or more than double what it had been in 1881. As usual in this province every district suffered, and the disease was more or less prevalent during every month of the year. It appeared in 27,314 villages, or 13·52 per cent. of the total number of villages in the province. In 1881 the proportion attacked had been only 8 per cent. The mortality in the towns equalled 4·79, whilst the rural mortality was 2·67. Notwithstanding the generally increased prevalence during the year, it is worthy of notice that eight districts of the province suffered less than in 1881; the disease was not so evenly distributed. The Sanitary Commissioner observes that "some places situated in the midst of, or surrounded by, cholera-stricken areas enjoyed great immunity from the disease." Such isolated areas of immunity were Noakhally, the Bhola sub-division in Backergunge, Jehanabad sub-division in Hooghly, the Sudder sub-division of Midnapore, Nya Dumka sub-division in Behar, and Aurungabad sub-division in Gya,—illustrations of the tendency exhibited by this disease to confine itself to certain localities.

In Assam, as has already been mentioned, cholera prevailed with great severity, and the mortality from this cause reached the high ratio of 4·69 against 1·12 in 1881. Every district and every town suffered, but in Kamrup and Nowgong it was especially severe. The districts of Goalpara and Lakhimpur at the two ends of the Brahmaputra Valley suffered least. It is worthy of note that, whilst cholera prevailed epidemically in Kamrup during January, February, and March, the districts immediately contiguous, Goalpara Darrang, and Nowgong were almost free of it. Of the towns Tezpur suffered most severely. Whilst the disease was most prevalent in the districts of the Brahmaputra Valley during May, June, and July, in the two districts of the Surma Valley, Sylhet and Cachar, it appeared most extensively during November and December.

After enjoying a remarkable degree of immunity from the disease for some time, the immigrant coolies again suffered on board the river steamers, and there were several outbreaks of cholera, those on the *Nepal* and *Sind* being attended with heavy mortality. The investigations which were made in the case of these and the other vessels concerned have only served to confirm the opinion expressed in former reports; and to show how hastily it had been assumed that the mere introducing of better arrangements for water-supply on board these steamers had almost entirely banished cholera from among the coolies travelling on them. It is worthy of notice, as the Chief Commissioner remarks, that "the disease was present in active virulence in the districts through which the vessels passed," and it is impossible, after a comparison of the years of cholera abeyance and cholera prevalence, to avoid the conclusion that the coolies on board the steamers escaped cholera, or suffered from cholera, in obedience to general causes which affected the ordinary population of the country and produced like results among them at the same time.

In the North-Western Provinces and Oudh also cholera was unusually severe. During January and February it prevailed chiefly around Allahabad; and from March to August in the districts lying to the north. When the epidemic ceased in the eastern districts it commenced in those to the north-west, and was especially severe in that part of the province which lies between the Ganges and the Himalayas. Here it prevailed epidemically during August, September, and October. The districts of Sitapur, Kheri, and Pilibhit suffered most severely. In them, out of 5,016 towns and villages, 2,069, or 41·2 per cent., were attacked. But many of them suffered in a very slight degree. Indeed, the Sanitary Commissioner writes that only 3·1 per cent. of them were attacked with epidemic violence.

The Punjab, as has often occurred in former years, enjoyed almost entire immunity from the disease. During 1882 only 39 deaths are reported to have occurred throughout the province. In this respect the year resembles the year 1877 when only 29 deaths were reported, and 1874 when 78 deaths occurred. The 39 deaths of 1882 took place in 15 different districts, and were spread over all the months of the year.

In the Central Provinces cholera prevailed more extensively than it had during the two preceding years. It was especially prevalent during May, June, July, and August. The Bilaspur district, where 2,285 deaths were recorded, suffered most; the other two districts of the Mahanadi division suffered much less. In the Raipur district only 449 deaths were registered, and in the Sambalpur district only 65.

In Berar the number of deaths registered as due to cholera was almost the same as in the year previous. The epidemic is reported to have followed upon the commencing decline of the disease in the Central Provinces. It is said to have showed itself almost simultaneously in four districts; namely, in Wun, Buldana, Akola, and Amraoti. The first case occurred on the 20th July in a village in the Wun district, and the second on the 21st July in a village in the Buldana district. These districts lie on the extreme eastern and western limits of the province, the Main Trunk Road running diagonally across a line drawn between them.

In the Madras Presidency, the disease, which had commenced late in 1881, continued with increasing intensity in 1882, and during the year the mortality arising from it exceeded that of any of the three previous years. The mortality increased from 613 deaths in 1880, and 9,446 in 1881 to 23,604 in 1882. The greatest mortality in this Presidency occurred at the very commencement of the year.

Cholera prevailed with considerable severity in British Burma, but was very restricted in its distribution. Only 232 villages of 14,942 were attacked. The death-rate was 1·96 per 1,000 of population against 1·52, the mean of the previous five years, or 1·42 in 1881. This last ratio was the highest of any province in India during 1881. The largest number of deaths occurred in July, but in December also the mortality was great. The Prome and Tavoy districts suffered most severely. It is worthy of note that the districts of Mergui and Moulmein, between which Tavoy is situated, suffered little.

With the exception of the Punjab and Berar, Bombay is the only province in which the cholera mortality during 1882 was less than in 1881. The deaths were fewer than the mean of the previous sixteen years, the death-rate having been 0·48 against 1·31, the mean of those years. Of 24,431 villages, 804 were attacked, or 3·2 per cent. The districts of Satara and Belgaum suffered the most severely.

In Rajputana and Central India the mortality was somewhat greater than usual. The statistics from this part of the country are more than ordinarily imperfect. From the data available it would appear that the States of Bhagelkhand and Bundelkhand suffered most.

In Mysore the disease prevailed more extensively than during any year since 1877, but was less than it had been during 1875, 1876, and 1877. In Coorg the mortality registered was nominal, but registration there is still very imperfect.

In the special Cholera Reports and Registers little information of value is given as to the effects of antecedent fatigue, exposure, and other like causes upon the development of cholera in individual cases. Amongst British troops in three cases excessive drinking is mentioned; in four cases exposure to great heat; in two the patients were attacked while in hospital under treatment for dysentery; in three there had been unusual physical exertion immediately before attack. Amongst native troops the following examples may be cited. A sepoy of the 4th Native Infantry at Alipore was attacked with cholera in the train on the 27th January while returning from Sultanpur in Oudh, where he had been on leave. This case is ascribed to fatigue and irregular feeding; 103 deaths from cholera had been registered in the district of Sultanpur during January, and it appears probable that he had contracted the disease before he commenced his journey. A sepoy at Bhagalpur, after having undergone considerable fatigue fasted the next day, and the following day being his birthday he feasted extravagantly, and was shortly afterwards attacked. Cholera was at the time present in the district. In another case, that of a commissariat dooly-bearer in Saugor, it is stated that the man was attacked a few hours after eating a large quantity of green cucumbers. About the same time numerous deaths from this disease were being registered in the district. In the jail records the following facts have been gathered in this connection. The first of 11 cases in the Shahabad jail occurred in the person of a boy of poor physique, who had been transferred from Buxar during very hot weather (May). It should have been noted, however, that cholera was just springing into activity at that time throughout the Shahabad district after a quiescence during the previous two months. At Berhampur (Madras) a Mahomedan State prisoner was attacked on the 29th June, which was the 18th day of the Ramazan festival. During this festival, instead of eating three times during the day as usual, he took one large meal between midnight and 3 a.m. This meal was cold, having been cooked some hours previously during the day. Cholera was very prevalent in the district during June, the maximum number of deaths for any month having been registered in that month. Similar instances occurring amongst the prisoners might be cited, but none of them are so striking as to deserve special mention.

Of the various stations occupied by European troops in which cholera appeared, diarrhœa was said to have been prevalent both before and during the outbreak in only two of them—Benares and Nusseerabad. Slight diarrhœa was observed in conjunction with the cases which occurred in Chunar, Lucknow, and Agra. In a battery of artillery, on the march from Kamptee to Bangalore in October, diarrhœa was prevalent when cholera broke out. Amongst native troops in the great majority of cases, diarrhœa is stated not to have been prevalent. In jails the prevalence of diarrhœa during periods of cholera invasion is more frequently noted, but no general rule can be laid down on the subject.

Of the 374 buildings occupied by European troops in the stations where cholera appeared, cases of the disease occurred in 64, or in only 17·1 per cent. of the total. This average result is much modified at particular places—in some the cases were almost solitary and confined to solitary buildings, in others, again, a much larger proportion of the occupied buildings furnished cases. In Benares, for example, the disease appeared in 9 out of 14 buildings, and at Fyzabad in 20 out of 32. Of 3,304 buildings occupied by native troops among whom cholera appeared, only 78, or 2·3 per cent. of the total, furnished cases. Of 666 jail buildings 115 furnished cases, *i.e.*, 17·2 per cent.—a percentage almost identical with that of the buildings occupied by European troops.

With regard to atmospheric and other allied conditions attending outbreaks, little has been recorded which is worthy of notice. At Benares rain fell earlier and was heavier than usual. During the time the disease was at the station the wind was strong and steady from the due east. On the 25th July the wind changed to south-west with heavy rain, and the disease, from which there had been two admissions that day, making a total of 11 up to date, ceased. The wind remained westerly until the 29th, when it changed to the east, and fresh cases occurred. At Fyzabad, where 38 cases occurred, including followers, the atmospheric conditions were these: The wind was almost constantly from the east—very rarely from the west, and often high in the morning. As the day advanced the wind fell, clouds gathered as if for rain, but none fell. The thermometer varied from 76° at 6 a.m. to 103° at 4 p.m. At Agra, where a case occurred on the 12th July, the weather is said to have been intensely hot, with an unusual stillness of the air, and no rain. At Nusseerabad, on the other hand, the weather was "cool and pleasant," with a plentiful rainfall, accompanied by high winds, thunder, and lightning. The atmospheric

and telluric conditions attending an outbreak in the Dacca jail are interesting. Forty-eight cases occurred in this jail between the 26th May and the 20th August. The monsoon burst on the day preceding the first case, *i.e.*, on the 25th May, when 1·38 inches of rain fell, and during the remaining days of May 7·32 inches fell. During the first week of June 3·13 inches fell. A sudden disturbance of the subsoil water-level was also observed. There had been a nearly uniform subsidence of the subsoil water-level from 13 feet to 19 feet on the 3rd May, which was the lowest point reached during the first half of the year. From the 3rd May there was a steady rise to 15·9 on the 16th May. It fell again to 17·8 on the morning of the 26th May. From this date it rose to 10·1 on the 1st June. It stood at 11·3 on the 2nd, and rose to 9·10 on the 5th, after which it fell steadily to 13 on the 12th and 12·10 on the 13th. It then rose in a single day to 6·2, and on the 15th to 5·1, after which it declined to an average level of 7·6. From the 26th May, the date of the first case, cases occurred frequently up to the 10th June, when the disease ceased for a time, no other case occurring until the 20th July. The epidemic is thus said to have been coincident with the fall of rain and a sudden disturbance of the subsoil water-level. Against this, however, may be read the remarks by the same officer regarding the smaller outbreak in the Lunatic Asylum at Dacca, where eight cases occurred between the 26th July and 1st September. Here it is stated that the cases coincided with a paucity of rain, lowness of the river, and a remarkable falling of the subsoil water-level.

The data supplied regarding the supposed connexion of the first case with any other affected person are, on the whole, very unsatisfactory. No serious attempt appears to have been made to investigate the question upon clear evidence. Thus, the medical officer at Banda says that a connexion exists between the first suspicious case, a mess kidmatghar, attacked on the 30th July with violent abdominal pains, accompanied by a weak pulse, sunken face, but no purging, vomiting, or suppression of urine, and the first undoubted case of cholera. The medical officer at Saugor reports that "the most "probable cause is, that the man returned from a journey to Jubbulpore with the germs "of cholera poison in his system, which were afterwards set in action by the food, "partaken at an abnormal hour." Cholera, as a matter of fact, was at the time present in the Saugor as well as in the Jubbulpore district. The medical officer of the Thayetmyo jail writes:—"The first case occurred in the person of a native of India "who was engaged as a cook. He had previously enjoyed good health. He had been "in jail four months and 20 days, and had not been outside the gate since his admission. "The only possible way he could have contracted the disease was by handling the "vegetables which came from the bazaar, where cholera was prevalent." Five men attended upon the sick, and yet not one of them was attacked. At Gauhati, one prisoner of a gang of 20 who worked outside the jail, and about a quarter of a mile from a bazaar in which five cases had occurred, was attacked. No other case occurred either among the remaining 19 men of the gang, or indeed throughout the jail, and not one of the six men who attended on him was attacked. The medical officer still records it as his opinion that the one man attacked contracted the disease from the bazaar. At the Midnapore Central jail the medical officer writes:—"The first and only case occurred in one of a "gang of 24 prisoners who had just arrived in this jail on transfer from the Cuttack "jail. The gang had marched by road, a distance of about 170 miles, in 15 days, the "whole distance being on the pilgrim route. They had not been subjected to any "particular fatigue or exposure, and though there was no absolute certainty, there was "strong probability that cholera existed." The difficulty of ascertaining the exact facts and the tendency on the part of reporting officers to draw theoretical conclusions, instead of confining themselves to the logical deductions warranted by carefully collected evidence, are being constantly illustrated.

Among the European troops, 133 cases in all were treated; 574 persons attended upon them, and of these only four were attacked, or 0·69 per cent. Among native troops 121 cases were treated; 301 persons attended upon them, and of these three were attacked, or about 1 per cent. In the jails 391 cases were treated; 456 persons attended upon them, and of these 14 were attacked, or 3 per cent. The results are brought together in the marginal table, and it will be seen that of a total of 1,331 attendants only 21 were attacked, or 1·5 per cent. Between 1877 and 1881 data have been furnished regarding 7,859 attendants, of whom 149 were attacked. Adding the figures for 1882, the total stands as shown in the last line of the table. The total result of the

——	Number of Cases.	Number of Attendants.	Number of Attendants attacked.	Per-centages of Attendants attacked.
European troops	133	574	4	0·6
Native troops	121	301	3	1·0
Prisoners	391	456	14	3·0
Total	645	1,331	21	1·5
Grand total of 1877-82	4,999	9,190	170	1·8

inquiry then is that out of 9,190 attendants on 4,999 cases of cholera during the last six years, only 170 were attacked, and there is no evidence that the attacks of even these few were due to attendance on the sick.

Various insanitary conditions are noted in connexion with the disease. Bad drainage, bad drinking water, and bad conservancy are the chief. At Chunar it is said that the people bathe in and drink the dirty water of the Ganges, in which dead bodies are often seen floating. In connexion with the outbreak in the Dacca jail, the medical officer reports as follows:—"The water supply is defective. There are only two hydrants at "present for the supply of pure filtered water from the municipal works. They are "insufficient for bathing the prisoners and supplying them with drinking water. Con- "sequently, at the beginning of the outbreak half of the prisoners continued to be "bathed at the jail well or in the tank. The water in both of these is most impure, and "is unfit for use. Nevertheless, so great was the deficiency of pure water at the time "that the prisoners not only bathed there, but they also washed their plates and rinsed "their mouths there after meals, and water from these sources was used to wash "and boil vegetables, &c. in the cook-houses. Four days before the outbreak the "municipal water also failed, and for one day (the 22nd of May) all the water used for "all purposes was taken from the well or tank. On the 23rd the municipal engines "were again at work as usual. Towards the end of the epidemic the use of any but "municipal water was forbidden, but without any marked effect on the progress of the "epidemic, which had already shown the usual signs of amelioration which is always "noticed in the later cases seized."

The effect of the movement of affected troops and prisoners was beneficial in all cases. Amongst British troops at Benares after the first move no other case occurred. At Fyzabad a few cases occurred after removal into camp. The medical officer reports that movement was not unsuccessful. He further writes that, "judging from the improve- "ment in the appearance of the men after their sojourn in camp, I am of opinion that "the removal was beneficial to their health." At Lucknow the disease ceased upon first moving into camp, recurred after the seventh and eighth moves, and then died out. Amongst native troops, after the first move into camp at Bhagalpur, one case occurred, and then the disease ceased. At Deolali, movement into camp at once arrested the disease.

Small-pox.

The mortality from small-pox throughout India exceeded that of the preceding year, the total number of deaths having been 85,131, against 74,153 in 1881. The largest number occurred in the North-Western Provinces with Oudh and Madras, but the highest proportion per 1,000 of population was in Mysore and Coorg. The combined results for the whole of India show that the greatest mortality occurred during the months of May and June. A gradual increase in the number of deaths took place from the beginning of the year to the months of May and June. Thereafter the disease subsided. In November a sudden re-accession took place, reaching a maximun in December, which, however, was not so great as the maximum in May and June. Thus there were two periods of increased small-pox mortality during the year, one gradually rising during the hot season, the other more suddenly reached during the cold weather. These two periods are usually the dryest seasons throughout the greater part of India.

Fevers.

The mortality from fevers decreased during the year. Throughout India 3,125,366 deaths were registered under this head, against 3,175,293 in 1881. By comparing the actual number of deaths in each province with the number of deaths which occurred in 1881, it is seen that the increase over 1881 occurred only in Assam and in the Central Provinces. The actual number of deaths registered in Assam during the year under review was 60,218, whilst in 1881 it was only 42,553; in the Central Provinces the number was 152,407, against 143,933 in 1881. More than one-third of the total mortality in Assam was registered in the single district of Sylhet. The largest actual number of deaths, as well as the largest mortality per 1,000 of population, occurred in the North-Western Provinces and Oudh. Here the rate of mortality (24·95) remained almost identical with what it was in 1881. The mortality of 1881 was somewhat higher than that of 1880, but very considerably less than that of 1879. The people of the Punjab suffered next. In Bengal the fever mortality diminished as compared with 1881, but was still considerably higher than it had been in 1879 and 1880. There has been a gradual decrease in the fever mortality of the Madras Presidency during the last four years; in 1882 it amounted only to 6·5, the lowest ratio registered in any province. With regard to the distribution of fevers by seasons, the largest number of deaths occurred during the months of October, November, and December. The mortality began to increase in August, and rose to a maximum in November and December. It was slight in January, and at its minimum in June.

Bowel complaints.

The total deaths recorded throughout India under the head of bowel complaints amounted to 280,016, against 259,150 in 1881. The largest number was recorded in the North-Western Provinces with Oudh, but the mortality per 1,000 of population in that province was not so great as it was in Berar and Assam. The largest death-rate occurred in Berar, and the smallest in Madras. Regarding the monthly distribution of these diseases, the largest number of deaths occurred during August and September. A decided rise in mortality commenced in July, and was at its minimum in February.

Injuries.

The remarkable uniformity in the mortality from injuries, and even in its seasonal distribution has been noted in former reports, and the year under review forms no exception. The total number of deaths throughout India was 74,041, against 73,403 in 1881.

All other causes.

The total number of deaths registered from all causes other than those dealt with in the foregoing paragraphs was 831,361, against 806,287 in 1881. There was thus a considerable increase. The highest ratios per 1,000 of population were recorded in the Central Provinces, Berar, and Madras, all of which show ratios above 7 per 1,000 of the population.

Vaccination.

By far the largest number of vaccinations was performed as usual in Bengal Proper; but the largest average number of operations to each vaccinator (1,921) was performed in Berar. In Bengal, North-Western Provinces and Oudh, Punjab, and Coorg, the total fell short of that of the preceding year, but in the Central Provinces, Berar, British Burma, Assam, Madras, and Bombay there was an increase. But the increase did not compensate for the falling off, and so it happens that whilst the total number of vaccinations performed throughout India during 1881–82 amounted to 4,571,166, they amounted to only 4,408,142 during 1882–83. The highest percentage of success in primary operations (98·87) was recorded in Bengal and the lowest (82·99) in Coorg. The average cost of each successful operation was at a maximum of 8 annas and 5 pie in British Burma, and at a minimum of 1 anna and 6¾ pie in Bengal. The percentage of annual estimated births successfully vaccinated was 58·7 in Berar; it was 3·5 in Assam, and only 1·7 in Coorg.

Although the Vaccination Establishment in Bengal Proper was considerably increased, a smaller amount of work was done. The total number of operations performed by the Special and Dispensary Establishments combined, was 1,261,425, against 1,349,607. There was thus a decrease of 88,182, but this decrease was not general; in some circles and districts there was an increase. Where work shows a falling-off the Superintendents offer various explanations, such, for example, as the prejudice amongst the people against the operation, want of assistance from the civil authorities, the prevalence of sickness, and the strong objection which exists to lymph being taken from the arms of children. Of the total number of operations 1,247,277 were primary, and 14,148 re-vaccinations. The percentage of success for primary operations of both the Special and Dispensary Establishments was 98·60, and for re-vaccinations 45·12. Of the total number primarily vaccinated 12·81 per cent. were infants, and 66·33 per cent. children between one and six years of age. Compared with the results of the preceding year, there was some improvement in the proportion of infants and children successfully operated on. Very satisfactory progress was made both in the extent and character of the work done by the licensed vaccinators. Early in January 1883 animal vaccination was commenced in Calcutta, and by the end of the official year a continuous supply of lymph had been kept up through 19 calves, the last calf having received the 18th transmission of lymph. 466 persons voluntarily presented themselves at the depôt for vaccination with calf lymph. Of these 340 were vaccinated for the first time. The results of these operations were not very satisfactory, as only 52·94 per cent. of them proved successful. A larger measure of success will no doubt be attained as the undertaking develops.

In the North-Western Provinces and Oudh the total number of persons vaccinated was 672,463, or 94,796 less than the number of the preceding year. Of these operations, 653,669 were primary with a success of 91·60 per cent., and 18,794 were re-vaccinations with a success of 25·99 per cent. The percentage of success in primary cases was nearly the same as that of the preceding year, when it equalled 91·70 per cent. It is estimated that 13·69 per 1,000 of the total population of these provinces were protected during the year. The very large decrease in the total number of operations performed is due to the smaller numbers in the second circle, which comprises the Oudh, Rohilcund, and Kumaun Divisions, and especially to great decrease in Oudh. There is strong reason, however, for believing that there was no real decrease during the year; the registers were more carefully checked, and fraudulent entries which were made by the

vaccination staff during former years in order to swell their returns were prevented. In the first circle, which includes the Meerut and Agra Divisions, much good work was done, and it is estimated that 64 per cent. of the births in these divisions were protected during the year. In the third circle, which includes the Jhansi, Allahabad, and Benares divisions, only 17·3 per cent. of the estimated births were protected. In the Benares division, taken by itself, the numbers protected are merely nominal. An abundant and good supply of lymph was available throughout the year. A new feature in the work of the year was the employment of two female vaccinators in zenanas. The experiment is favourably reported upon.

During the year 499,697 persons were vaccinated in the Punjab, compared with 673,487 in 1881–82. This large decrease is ascribed first to the abolition of the provincial staff of vaccinators, who in former years performed a considerable number of operations during the months from 1st April to 30th September; secondly, to the employment for a time of vaccinators of the western circle in the native state of Faridkote; and, thirdly, to the vaccination returns of the western circle for March 1883 not having been received in time for incorporation in the Sanitary Commissioner's annual report. Of the total number of operations, 496,800 were primary with a success of 95·11 per cent., and 2,897 were re-vaccinations with a success of 48·46 per cent. The average number of persons vaccinated by each vaccinator was 1,914, against 2,034 in 1881–82 and 2,618 in 1880–81. The ratio of successful vaccinations per 1,000 of population was 25·15, against 35·62 during the preceding year. Estimating the birth-rate of the year at 40 per 1,000, only 47 per cent. of the births were protected compared with 55·9 per cent. in 1881–82. In many districts vaccination appears to have been mainly restricted to children under six years of age. In order to facilitate vaccination in towns, a circular was issued directing the establishment of stations in various parts of cities at which vaccinators should attend at fixed hours.

During the year the vaccination staff in the Central Provinces was increased from 199 to 217. The work done by the Special Establishment was on the whole satisfactory. The number of operations increased from 369,651 in 1881–82 to 401,683. These figures, however, cannot be accepted as absolutely correct, since in these provinces also some false entries were discovered in the returns. In 8 out of 18 districts a smaller number of vaccinations was performed than in the preceding year. Of the total number of operations performed, 388,792 were primary and 12,891 re-vaccinations. The percentages of success were for primary operations 95·80 and for re-vaccinations 75·03. The vaccinations performed by hospital assistants attached to dispensaries were 32,008, exceeding the number of the previous year by 4,877. Of these all but 1,359 were primary vaccinations. Of the primary operations 91·73 per cent. were successful, and of re-vaccinations 65·05 per cent. Of the 372,462 successful primary operations performed by the special staff 156,734 were on infants, or 42·0 per cent. of the total number. Of those vaccinated by the dispensary officials 62·1 per cent. were infants.

Although no addition was made to the vaccinating staff during the year under review, the total number of operations performed by the Special Establishment in Berar rose from 90,169 in 1881–82 to 103,758, and the percentage of success in primary cases from 89·8 to 91·8. Of the 95,080 successful primary operations performed by the special staff no less than 58,348, or 61·3 per cent., were upon infants under one year old. Of the 5,685 successful primary operations performed by the dispensary staff, 3,502, or 61·6 per cent., were upon infants. Estimating the birth-rate at 40 per 1,000 of population, the number of infants under one year of age successfully vaccinated was 58·7 per cent. The average number of operations performed by each vaccinator rose from 1,670 in 1881–82 to 1,921 in 1882–83, or an increase of 251. No material progress was made in dispensary vaccination. The number of dispensary operations in the province as a whole exceeded those of the year previous by 1,282.

The special staff for British Burma was considerably increased, a native superintendent and 17 vaccinators having been added during the year 1882–83. The work done by each vaccinator, however, was less than it had been during the preceding year. The total number of operations performed was 55,095 against 50,677 in 1881–82. The want of a proportionate increase in the amount of work done by the increased establishment has been partly accounted for by the failure of the first supply of lymph from the National Vaccination Institution. In order to obviate a similar delay at the commencement of the vaccination season in future, efforts were made to establish animal vaccine depots at Thayetmayo, Toungoo, and Rangoon; but as these attempts failed in Thayetmayo and Toungoo, arrangements were being made for the establishment of a permanent depot in Rangoon only. The success attained during the year was 85·34 per cent. in primary vaccinations against 82·85 in 1882–83, and 60·41 in re-vaccinations against

50·25. Only 5½ per cent. of the estimated births were successfully vaccinated during the year, and only 12·50 per 1,000 of the total population. Three hundred and ninety operations were performed by the dispensary staff against 408 in 1881–82. All but nine of these were primary operations, and 69·55 per cent. proved successful.

In Assam considerable progress was made during the year. Altogether 58,537 operations were performed; the results could not be noted in 698 of these. Excluding them, the total number of operations was 57,839, or 12,593 in excess of the operations of 1881. This increase, however, was not very general throughout the province, it occurred in the districts of Sylhet and Darrang more particularly. In four districts a smaller amount of work was done, but especially in the Kamrup and Sibsagar districts. The falling-off in Kamrup is attributed to the reduction in the staff of ex-inoculators from 76 to 20. In Sibsagar, where the number of ex-inoculators was raised from 1 to 9, and the total vaccination staff from 15 to 19, there was also a decrease. Of the total 57,839 operations, 57,619 were primary and 220 re-vaccinations. The percentage of success in primary operations was 89·40, and in re-vaccinations 82·27. Of the 51,516 successful primary operations performed throughout the province, 6,284, or only 12·2 per cent., were upon infants under one year of age. Only 11·5 per 1,000 of the population, and 35·04 per 1,000 of the estimated number of births during the year, were protected. Tubes of human lymph, both from England and from various parts of India, were issued to all districts. All lymph excepting that from Bengal is favourably reported upon. Calf lymph in tubes from England and Bombay was also issued. It is said to have been in no way superior to human lymph. The compulsory Vaccination Act was introduced during the year in the Municipalities of Sylhet, Gauhati, and Dibrugarh; but no active measures were taken to enforce it. The rules framed under the Act for Sylhet were sanctioned by the Chief Commissioner at the close of the year, those for Dibrugarh and Gauhati were still under consideration.

During the year the Vaccination Establishment in Madras consisted of 712 vaccinators, and the total number of operations performed rose from 601,222 in 1881 to 661,133. The increase in the number of operations over those of 1881 was distributed pretty generally over all circles. In the towns of Madras and Tinnevelly and in the district of Tanjore, however, there was a notable decrease in the number of operations. Throughout the Presidency the percentage of success in primary operations was 92·8, and in re-vaccinations 45·8. A new feature in the history of the year's work is the employment of female vaccinators. Animal vaccination was carried on at the Vaccine depôt from April to September.

In the Bombay Presidency 851,444 operations in all were performed on 849,199 persons by both the Special Establishment and the medical subordinates attached to dispensaries. The difference between these numbers, namely 2,245, indicates the number of persons upon whom primary vaccination was in the first instance performed without success. The percentage of success attained by the Special Establishment was for primary cases 96·32 against 96·73, and for re-vaccination 71·74 against 72·52 in the year previous. The total number of operations performed exceeded that of the preceding year by 69,926. The ratio of persons successfully vaccinated per 1,000 of the population by the Special Establishment was 30·18 as compared with 25·25 in 1880–81 and 27·88 in 1881–82. The average number operated on by each vaccinator was 1,880 against 1,751 last year. Four hundred and sixty-four thousand seven hundred and forty-seven infants were successfully vaccinated, a smaller number than that in the preceding year. During the year a few additional vaccinators were entertained. Vaccination with animal lymph was more largely resorted to. In Bombay no other lymph is used, and it is gradually taking the place of arm-to-arm vaccination in the districts. Six hundred and forty-five heifers were inoculated, and all but 51 of them with success.

After a steady increase for some years in the amount of work done in Coorg there was a slight falling-off. Four thousand seven hundred and thirty-four operations in all were performed by the special staff, or 153 less than the number performed during the preceding year. Each vaccinator on an average performed 947 operations against 977 last year. Of the primary operations 82·99 per cent. were successful, and of the re-vaccinations 70·04 per cent. A prejudice appears to exist in this province against infant vaccination, and, as a consequence, only 2·5 per cent. of the whole number vaccinated were under one year of age; 36·1 per cent. of them were between one and six years. The number of operations performed by the dispensary subordinates was not one-half that of the previous year. They were all primary, and a success of 68·69 per cent. was attained. The extraordinarily heavy rainfall hindered the movements of the vaccinators from place to place. Arrangements were being made to extend the compulsory

Vaccination Act to several additional municipalities, and an increased establishment has been sanctioned.

The total number of persons primarily vaccinated in the British army was 1,076, and of these 899 or 83·5 per cent. were successful. The actual numbers vaccinated were smaller than those of the preceding year, but the percentage of success was considerably higher.

Civil Sanitary Works.

Excluding Calcutta, the total income of the municipalities in Bengal during 1882 amounted to Rs. 31,06,731. Of this nearly one-third was expended on sanitary arrangements. In the year previous the proportion so spent had been only 23·93 per cent. The increase was mainly due to municipalities having, under the new system, been relieved of the police charges. Attention was devoted to sanitary improvements in towns and districts in almost every part of the province. A few only of the most important of these works are noted here. Drainage schemes were either wholly or partially completed in Rungpore, Midnapore, Howrah, Naihati, suburbs of Calcutta, Darjeeling, Maldah, Gya, Bhagalpur, Cuttack, Pooree, Hazaribagh, and Lalbagh in the district of Moorshedabad. Plans were drawn up for the early execution of drainage works in Culna, Soori, Tumlook, Serampore, Berhampore, and Bhagalpur. In Burdwan survey operations were in progress in connection with the contemplated re-opening of the old channel of the Gogra river. At Backergunge ten *khals*, or old water-channels, were opened out. A good deal was also done to improve the drainage in the districts of Maldah and Nuddea. At Dacca a commencement was made in filling up the "gors"—the receptacles for generations of sewage, filth, and contents of privies. Improvement was also effected in the drainage and conservancy arrangements of Chittagong, and in the town of Durbhanga 347 pools of water and small tanks were cleaned out. In the suburbs of Calcutta and in Howrah several most objectionable native quarters were reclaimed and improved. The works in connection with the supply of filtered water from the Damuda river to the town of Burdwan made considerable progress. A project for supplying Bhagalpur with pure water was also in hand. Arrangements were being made for extending the Calcutta water-supply to the suburbs of the town and to Barrackpore. The question of providing a proper supply of water for the shipping of the Chittagong port, and a proposal for a common scheme of water-supply for the river side municipalities from Howrah to Serampore were also under consideration.

The following is a list of the sanitary works which were executed or undertaken in the North-Western Provinces and Oudh during 1882:—In Allahabad a scheme for water-supply was prepared and is under consideration, and an important outfall drain was partially completed. In Cawnpore Rs. 8,865 were expended chiefly upon the further construction of the *Sisamau* main drainage channel and some other minor drains. In Gorakhpur a scheme was prepared for draining the town site; and the chief line of this drainage was commenced. In Azamgarh a comprehensive project of drainage at an estimated cost of Rs. 35,000 was sanctioned, and the work was in hand. At Lucknow more than Rs. 17,000 were expended in constructing upwards of 18,000 feet of stone and masonry drains, a new slaughter-house, and some other smaller works. At Mussoorie the *Kuttapani* water-supply scheme was completed. At Bareilly plans and levels for the drainage of the city site were completed, and one of the main channels was under construction; a considerable amount of work was also done in improving, extending, and clearing the existing drains. At Almora a new reservoir was erected for the supply of pure water to the townspeople. At Nainee Tal Rs. 10,378 were expended in constructing a bathing *ghát* for the natives and in improving the drainage and locality generally. At Nagina Rs. 6,244 were spent in improving public wells and paving streets. At Shahjahanpur Rs. 11,505 were laid out in constructing new drains, in paving thoroughfares, and other improvements. At Burdwan Rs. 7,088 were expended on road-making and drainage. At Saharanpur Rs. 6,285 were spent in improving the water-supply, &c. At Hardwar a very important well was repaired and cleansed and the drainage of the Jawalapur site was in hand. At Deoband the Nabchagarh drainage channel was completed. At Roorkee the scheme for flushing the town drainage lines with canal water was perfected and successfully worked. At Mazaffarnagar four new drains were constructed, and the embankment which preserves the town site from being flooded was improved. At Meerut Rs. 11,974 were laid out in constructing drains and improving streets. At Bulandshahr Rs. 6,000 were expended in constructing a masonry embankment for the reclamation of low ground near the river, and the drainage of the

town was remodelled by levelling certain mounds and filling up excavations. At Khurja the great public tank, which was being constructed at a cost of Rs. 15,000, was completed.

The income of the municipalities in the Punjab during the year amounted to Rs. 39,84,381. Of this sum Rs. 11,22,279 were expended on sanitary work, including vaccination. The only scheme of any magnitude which was undertaken during the year was the adoption by the Amritsar municipality of projects for supplying the city with pure water, and for a more perfect system of drainage both within and outside the city walls. At Lahore some progress was made in the drainage of the city, and measures were in hand to supply the place of the city reservoir, which had given way. Preliminary arrangements were being made for a better water-supply for Rawal Pindi. In Peshawar the water-channel for the city was completed up to the Kotwali. The construction of a second reservoir for water at Simla progresses slowly; the sewage scheme recommended some years ago was not yet commenced. Works in connection with the improvement of the Dalipgarh Fort drainage, the construction of a reservoir at Zam outpost, and a covered water tank at the Draband outpost were all in progress. Many minor improvements were carried out in several municipalities. The conservancy arrangements of towns also were reported to have been well attended to, and upwards of four lakhs of rupees were expended for this purpose. The vaccinators are gradually being utilised in aiding village sanitation.

In the Central Provinces the most important sanitary event was the completion of the water works at Jubbulpore. At Hinganghat also works of this kind were nearly completed. Schemes for the drainage of Kamptee and for a supply of pure water to it were under consideration. At Nagpur the Ambajhari water service to private houses in the city was extended, and more than Rs. 35,000 were expended on conservancy and various other sanitary measures. In Seoni, and many other districts, steps were being taken to provide the people with a better water-supply by sinking new wells and cleansing and repairing old wells and tanks; 226 new wells were sunk during the year throughout the province.

In Berar Rs. 1,73,684 were allotted for sanitary purposes, and of this sum Rs. 1,41,822 were actually spent. In the districts of Wun and Buldana the amounts expended were small. In the Akola district Rs. 51,058 were spent on conservancy, drainage, water-supply, and other works of a minor nature. In Amraoti, Rs. 27,639 were spent; in Ellichpur, Rs. 25,705; in Basim Rs. 18,615. In municipalities the most important works on hand during the year were the water-works for Amraoti and Khamgaon. Great improvements were also being made in the drainage of Akola. In the rural circles of Akola, Basim, Ellichpur, and Amraoti considerable sums were spent on improving the sanitary condition of the villages.

During the year Rs. 53,000 were spent on general sanitary improvements in Assam. All these appear to have been carried out in towns, as no mention is made of improvements in rural circles. At Shillong the water-supply by pipes, which up to this time had been restricted to the regimental lines and bazaar and to the suburbs of Maokar, was extended to the central parts of the village and police bazar. Further, a scheme for supplying pure water to the station at a cost of Rs. 12,984 was adopted and the work commenced. At Goalpara works for draining the water-logged town area were progressing satisfactorily. At Gauhati, in addition to works directed to the reclamation of the swamps adjacent to the town, the municipal commissioners accepted a project for the supply of pure water at an estimated cost of Rs. 38,214, and the works were commenced. At Golaghat a scheme for draining low swampy ground was under consideration. Attention was also paid to the cleanly preservation of tanks used for domestic purposes, and proposals were made to introduce Norton tube-wells at suitable places. At Kohima a scheme for the introduction of drinking water by pipes instead of by open channels was accepted and work commenced, settling tanks and filtering beds having already been constructed. Water for other purposes will still continue to be drawn from open channels. At Silchar station rules under Act V. (B.C.) of 1876 were sanctioned, enabling the commissioners to carry out measures for an improved water-supply, efficient drainage, and general conservancy.

The most important work under construction in British Burma was the water-supply of the town of Rangoon. As noted in last year's report, this was being vigorously pushed on. By the end of 1882 it was approaching completion, and a limited supply of water was furnished to the town. During 1883 the work has been finished. At Prome the drainage and waterworks which had been sanctioned during the previous year were under construction. A scheme for supplying Bassein with pure water was being examined, and a provincial grant of Rs. 50,000 has been provided for the purpose. In the town of Mergui Rs. 7,145 were expended in sanitary works and general improvements. Twenty-

four new municipal committees were established during the year, and it is hoped that much good work may be done by them in improving the sanitary conditions of their towns.

No special sanitary work of any magnitude was accomplished in the Presidency of Madras. During he nine months ending December 1882, Rs. 5,61,948 were expended on works of minor importance, such as cleansing and repairing the sources of water supply, the construction of culverts and drains, &c. Of the above sum Rs. 3,54,708 were contributed by municipalities, and Rs. 2,07,240 by local fund circles. Rs. 3,91,841 were spent on conservancy, and Rs. 37,061 on the improvements of towns and villages.

In the Bombay Presidency also no work of any magnitude was executed during the year. Much, however, of minor importance was accomplished in Municipalities and Local Fund Circles, such as cleaning and repairing sources of water-supply, repairing masonry drains, constructing latrines, &c. In municipal towns, out of a total income of Rs. 29,19,425, Rs. 7,22,280 were expended on conservancy. The municipality of Roha Ashtami in the Colaba district are constructing waterworks at a cost of Rs. 19,869. At Kaira a scheme for the better drainage of the town was under consideration. At Ahmedabad Rs. 17,096 were expended upon repairs to gutters, drains, roads, city wells, &c. At Poona the waterworks were extended at a cost of Rs. 10,707, and Rs. 8,087 were expended upon new buildings for the night-soil depôt. The amount realised by the sale of poudrette in this city during the year was Rs. 30,776. At Kurrachee the streets and lanes of the native town and Sudder bazaar were paved, and several deep drains replaced by shallow saucer drains. Schemes for the better drainage of the cities of Hyderabad and Sukkur were under consideration. In the Local Fund Circles Rs. 73,818 were spent on sanitary works of minor importance.

General Remarks.

Cholera epidemic in Egypt.

The principal facts regarding the history of cholera in India during 1882 have already been recorded. Under ordinary circumstances the disease, as it appears in other parts of the world, does not call for notice in this report, but the recent epidemic in Egypt, and the endeavour which has been made to connect this epidemic with India deserve serious attention. The facts are still very imperfectly known, and many of them in all probability can never be ascertained with accuracy. So far as they are known, they seem to be briefly these. Between the 16th August and 13th September 1882, 19 cases of cholera occurred at Camaran, an island in the Red Sea, only a few hours' steam from Aden. This island has been converted by the Turkish authorities into a regular quarantine station, and here all pilgrims going from India to the Hedjaz are compelled to remain under observation for a certain period, even although they have started from healthy ports and arrive in healthy ships. It was among Indian pilgrims in quarantine on Camaran that all but one of the 19 cases occurred. In Mecca and Medina and other places connected with the Haj, 619 deaths from cholera were reported to have taken place between the 23rd October and 6th December 1882. The details are given in the margin. Early in October 1882 also, a few cases were said to have occurred at Hodeida, but no particulars have been furnished regarding them. In Egypt the first case was announced at Damietta on the 23rd June 1883; and by the end of September, when the disease had almost entirely disappeared, it was computed that nearly 30,000 persons had died from it. No official report of the epidemic has yet been received in India, but it would appear that deaths from cholera had occurred in Egypt as early as April, and that isolated cases of true Asiatic cholera are met with more or less every year in that country.

In Mecca	324
Between Mecca and Medina	21
In Medina	248
In Jeddah	12
In Confuda	3
In Lithe	8
In Rabak	3
Total	619

To those who believe that cholera can originate nowhere except on the delta of the Ganges, and that all the epidemics which occur in other countries must be due either directly or indirectly to importation of the disease from India, the appearance of cholera in Egypt and other places out of India is very easily explained—the "germ" or "contagium" or whatever else is believed to represent or contain the supposed specific poison of cholera must have been conveyed from India. But until it has been conclusively proved that a peculiar entity does exist in all cases of cholera, and that this is the specific germ or cause of the disease, all arguments based on the assumption that such a germ does exist are mere speculations. The facts must be dealt with as they stand apart from all hypotheses, and all the facts which we do know regarding the disease must receive very careful attention. The questions involved are of

far too great practical importance to be decided on a merely theoretical basis, and fortunately there is a large and very valuable mass of evidence available in regard to them.

The views in regard to cholera which are now so generally accepted and all the measures of quarantine adopted in Egypt and along the Mediterranean littoral, which have for their object the protection of Europe against an invasion of cholera from the East, rest upon the conclusions and suggestions of the International Conferences which met at Constantinople in 1866 and at Vienna in 1874. These suggestions were based upon two main propositions—*first*, that cholera is produced originally in India and in India only; and *secondly*, that all the epidemics which occur in other countries are due to importation of the disease from India, either directly or indirectly; but in the interests of India and of scientific truth, it is quite impossible to accept them until very much stronger evidence has been adduced in their support than was produced at either of these conferences. Theoretical discussions on matters of this kind are not likely to lead to any practical results. The important point to be determined is not what are the theories but what are the facts, and the first practical question to be answered is—Have Indian ports and Indian ships been a source of danger to Egypt and other countries? If India stands to cholera in the relation which is generally believed, then the experience of ships sailing from Bombay and other Indian ports for a long series of years, and practically subject to no quarantine restrictions, should furnish incontrovertible and overwhelming evidence of the truth of the conclusions; but there is no evidence of the kind in existence. For thirty years and more, during which Egypt has been in direct and constant communication with India, the supposed danger has existed, and yet during all that time has never once manifested itself. The experience of the ten years, 1865 to 1874, is fully set forth in an official report which has been issued by the Local Government Board.* From this report it appears that in 1865 cholera appeared in Egypt and Europe, and that it continued with more or less severity in certain European countries up till 1874. Opinions are divided as to whether the cholera of these ten years should be considered as one epidemic or be divided into two—the first extending from 1865 to the end of 1868, and the other from 1869 to 1874. But as concerns the question at issue, this point is immaterial; for during all this time there was no importation of the disease by means of ships from India. This is fully admitted by the reporting authorities, who yet are firm believers in the main propositions of the Constantinople and Vienna Conferences. In 1865 the invasion of the disease was at first attributed to vessels arriving at Jeddah; but on this point Mr. Simon writes:—

"He (Mr. Radcliffe) shows that before the arrival at Jeddah of the particular ship which the Conference believed to have infected the Hedjaz and thus to have started the great outbreak of 1865, cholera had for some time previously been extensively prevailing both in the Yemen and Hadramaut provinces of Southern Arabia, and also in the Somali country on the African side of the Gulf of Aden; that the ships in question instead of having brought cholera from further east had probably contracted it at Makallah."†

To the above may be added the experience of the years since 1874 as set forth by Mr. Netten Radcliffe in a subsequent paper.‡ Adding the two series of years together it then appears that during the eighteen years, from 1865 to 1882, to which these special reports refer, so far as is known, there is no ground for supposing that Indian ships have imported cholera either into Egypt or into Europe. What is perhaps, even more striking, is the further fact that although Egypt has been in direct and never-ceasing communication with India throughout this time, it has preserved a remarkable immunity from cholera. The general distribution of the disease in Europe and Asia is shown succinctly in the maps attached to Mr. Radcliffe's first report. There was cholera in Egypt in 1865; but, as already explained, this was not imported by ship from India. In 1866 there was a slight re-appearance of the disease in Egypt, but there was apparently no cholera in Egypt, certainly no epidemic of cholera again, until 1883.

During the ten years, 1865 to 1874, which the first report above referred to embraces, there is not a single year in which Europe was absolutely free from cholera, and in some of them after 1866, as in 1867, 1869, 1870, 1871, 1872, and 1873, there was considerable prevalence. In other words, notwithstanding the supposed danger from Indian ships, Egypt for seventeen years was altogether free from the disease, and yet during many of these seventeen years India has suffered from most serious epidemics of cholera. The

* Report of the Medical Officer of the Privy Council and Local Government Board, new series, No. V., being "Papers concerning the European Relations of Asiatic Cholera."

† Page 7.

‡ "On certain appearances of cholera in the countries lying between Europe and India since the year 1874." —Transactions of the Epidemiological Society, London, Vol. IV., Part IV., page 287.

experience of Aden is even more striking; it suffered from cholera in 1865, and again to a slight extent in 1867 and 1881; but although it lies within a few days of Bombay, and although it has been in daily communication with that and other Indian ports, it did not once suffer from cholera during the thirteen years, 1868 to 1880. It is not necessary to go back further than 1865, and it would be difficult to ascertain the facts for the earlier years with any accuracy; but so far as they are known, they confirm the experience of more recent times. The fear of the importation of cholera from India into Egypt and Europe by means of ships is based only on the theories of the Conferences as to what ought in their opinion to have taken place, but what, so far as the evidence goes, never actually has taken place. In the face of these facts it is impossible to maintain that Indian ports and Indian ships have proved a source of danger to Egypt, and through Egypt to other countries.

Not only has it been assumed that ships must necessarily be the means of carrying cholera from India, it has also been assumed that times of special cholera prevalence in India are also times of special danger of importation of the disease by the Red Sea route; but the experience of the past does not warrant any such conclusion. In five of the six years after 1874, since which there has been no cholera epidemic in Europe, there was great cholera prevalence over India. The years 1875 to 1879 were years in which, owing to famine and other causes, the people of India suffered from cholera most severely, yet with all this there was not, so far as is known, the smallest sign of cholera at Aden, in Egypt, or in Europe during this period. Or, if the statistics of the Bombay Presidency be separated as the place which lies farthest to the west and may therefore be considered the greatest source of danger, the same general facts stand out,—great prevalence of cholera in India and remarkable immunity elsewhere. Not only is it true that cholera prevalence in India does not mean danger to Europe through Indian ships, but it might even be shown that other countries have often commenced to suffer from cholera when in India itself cholera had declined below the average or was at a minimum.

The same truths are further illustrated in part by the experience of 1883. In June of this year, if not as early as April, as already stated, cholera appeared in Egypt. What was the cholera history of the two main Indian ports during the early part of the year when it is assumed that cholera was carried to Egypt? In Bombay, which is more immediately concerned as lying nearest and furnishing the point of most frequent communication, the total deaths registered as due to cholera, according to the weekly returns falling within the first five months of each year, stand thus for 1883 as compared with previous years.

Bombay Cholera Deaths.

	1878.	1879.	1880.	1881.	1882.	1883.
January	36	34	8	—	109	2
February	106	12	4	—	51	1
March	187	11	10	3	17	1
April	174	9	4	5	5	11
May	145	29	2	72	1	82
TOTAL	648	95	28	80	183	97

From the above, it appears that during the early part of 1883 Bombay suffered from cholera to a less extent than usual. If the returns for individual weeks be taken separately, this fact is even more strikingly apparent than in the above statement, for, from the beginning of January up to the second week of April, only four deaths from cholera had been registered out of the whole population of this large city. In the town of Calcutta, as may be seen from the following statement, cholera was more prevalent than in the former years here entered; but the previous history of cholera in Calcutta, extending over many of the years which have been already referred to as years throughout which Egypt preserved immunity from the disease, is much more unfavourable than it was in 1883.

Calcutta Cholera Deaths.

	1878.	1879.	1880.	1881.	1882.	1883.
January	62	75	76	55	120	195
February	81	53	105	70	108	114
March	330	156	80	200	109	248
April	296	165	66	408	373	459
May	150	347	58	138	329	383
TOTAL	919	796	385	871	1,039	1,399

The point to be decided is whether there is anything to connect the Calcutta cholera of 1883 with an outbreak elsewhere. No ship going from Calcutta to the Red Sea in either 1882 or 1883, so far as is known, suffered from cholera, or is connected even in point of time with the appearance of the disease elsewhere. In the case of two ships which went from Bombay within the last two years, an attempt has been made to connect the appearance of cholera in other countries with their arrival from India. The one is the case of the *Columbian*, which was supposed to have caused cholera at Aden in 1881. This case was fully discussed in last Annual Report, and the grounds were fully stated for coming to the conclusion that the *Columbian* had nothing whatever to do with the production of cholera at Aden. Since the last report was published, this view has been further supported by the subsequent history of the *Columbian*, which landed her pilgrims at Jeddah without any signs of cholera among them either then or during the voyage.

The other case to which some importance has been attached deserves detailed mention. The *Hesperia* left Bombay on the 12th July 1882, having 501½ passengers on board.* Between Bombay and Aden four deaths occurred, which reduced the total to 497½, or say 498. But, on the other hand, 11 stowaways were discovered, which raised the number to 509. One passenger died at Aden, leaving a total of 508. If the infants in arms were counted at Camaran, the total would be 513, and allowing for one birth on board, or the counting of a child about 12 as an adult, the number of 514 found on board at Camaran would be made up. The seeming discrepancies in the number of pilgrims, which were regarded as suspicious, are thus fully explained. The *Hesperia* carried a medical man, believed to have been formerly in the Indian Subordinate Medical Service, but his name and rank are not known. Of the pilgrims, four died between Bombay and Aden, *viz.*, two from an accident due to a heavy sea striking the ship, one from chronic diarrhœa, and one from old age and debility combined. On arriving at Aden on the 26th July the pilgrims were inspected, and found to be fairly healthy, though many of them were old and emaciated. It is to be noted that between Bombay and Aden there were only four deaths, and not six, as has been supposed, and that there is no ground whatever for supposing that anyone of the four was due to cholera. On arriving at Aden, one of the crew, a fireman, who had been suffering from diarrhœa with inflammatory symptoms for four days, was taken to the hospital on shore, where he recovered. The medical officer at Aden gave it as his opinion that this was not a case of cholera. Late, however, on the 26th July (the day of arrival), a European coal-trimmer was attacked on board with what was reported to be cholera, and died next morning. This man had not been on shore at Aden. On the 28th a very old pilgrim was attacked with diarrhœa, and died on the 29th. On the 3rd August a seaman belonging to the ship was attacked with diarrhœa, brought on by eating tamarind, and recovered. The vessel remained in quarantine at Aden up to 6th August, when she left for Camaran. It is to be noted that there was no cholera or choleraic diarrhœa at Aden when the *Hesperia* arrived, and that, according to the latest report on the subject, dated the 15th October, there had been none after she left. The only case of cholera occurred on board the ship. The *Hesperia* arrived at Camaran on the 8th August, and landed her pilgrims next day. She had taken no fresh passengers on board between Aden and Camaran. According to Dr. Duca's account, two suspicious cases occurred on the 10th, but it was not till the 16th, or eight days after arrival, that the first undoubted case of cholera occurred. Dropping cases followed at intervals up to the 13th September. In all there were 19 cases at Camaran, of which 17 were fatal. It

* 498 adults and 3½ children under 12 years of age = 501½, or say 502, besides 5 infants in arms not counted.

would appear that all the cases were from among the *Hesperia* pilgrims, excepting that of a "guardian," an Arab, who was attacked on the 4th, and died on the 5th September. It has been asserted that the cases at Camaran were due to importation of the disease by the *Hesperia;* but, in order to strengthen this conclusion, it is assumed that the two deaths of pilgrims between Bombay and Aden, which are ascribed to ordinary diseases, were really due to cholera. The facts, as given in evidence, have been above stated, and the evidence goes distinctly to prove—

(1) that there was no case of cholera on board the *Hesperia* between Bombay and Aden;

(2) that the first case of cholera on board occurred at Aden after an absence of 13 clear days from Bombay; and

(3) that there was no outbreak of cholera among the pilgrims carried by the *Hesperia* until they had landed at Camaran.

It appears more than probable that this result was due in large measure to the privations, the discomforts, the overcrowding, and other insanitary conditions to which the pilgrims were exposed on this island. And this opinion is further supported by the fact that the crew of the *Hesperia*, who were not exposed to these conditions, but remained on board the vessel, did not suffer, although it was one of their number, and not a pilgrim, who died of cholera at Aden.

As already mentioned no official report has yet been received of the Egyptian epidemic of 1883; but the facts, so far as they are known, are all strongly opposed to the idea that the cholera was imported from India. No serious attempt has been made to connect the disease at the Hedjaz with any facts of supposed importation. The insanitary condition of the places visited by the pilgrims has long been a matter of notoriety—the filth lying in every direction, the foul water, the abominable smells, and the crowding of the pilgrims in unwholesome quarters. Every condition in fact seems to have existed which could favour disease. Had the first cases in Egypt appeared at Suez or any place near the southern seaboard, there would have been a *primâ facie* ground for suspecting importation; but the first cases occurred not only on the Mediterranean side, but also at the obscure and decayed port of Damietta, which has no direct communication with India. All attempts to connect the first cases with Indian arrivals, either directly or indirectly, have altogether broken down. On the other hand, there is ample evidence to show that Damietta and the other places which suffered were in the most insanitary state. Both at the Hedjaz and in Egypt the outbreak of cholera was thus coincident with a gross neglect of all sanitary laws. Experience moreover in Egypt has shown that all the endeavours made to separate the sick and to cut off places where the disease appeared from communication with the surrounding countries,—all isolation, disinfection, and so-miscalled sanitary cordons,—had no effect in localising the disease or in arresting its progress. On the contrary, there can be little doubt that all these measures did much mischief; that they increased the sickness and added much to the misery of the people.

The imaginary nature of the danger to which Egypt and Europe are exposed by arrivals from Indian ports is further illustrated by the remarkable exemption from cholera which many parts of India have been enjoying during this time of unusual alarm. If distant countries have been exposed to the constant risk of importing cholera by ships because the disease had been prevalent in chief ports of Calcutta and Bombay, the risk to other parts of the country, communication with which is constant and rapid by means of railways, must have been very much greater; but it is a fact of great significance that while certain districts and provinces of India have of late been suffering more than usual, others have as usual enjoyed remarkable immunity from the disease. This is particularly well illustrated in the case of the Punjab, which during the last two years has registered very few deaths from cholera. Out of a population of 18,842,264, the number of these was only 39 in 1882 and 190 in 1883 up to the end of November, the latest month for which statistics have yet been received. And the same truth is illustrated by the distribution of the disease not only in the Punjab but also in other provinces, in which nothing can well be more striking than the very small proportion of villages attacked. In the North-Western Provinces, for example, 10,338 were attacked in 1882 out of 105,421. In the Central Provinces 1,605 out of 27,529. In Berar 481 out of 5,238, and in the Punjab 30 out of 34,973.

But although the views of the sanitary boards in Egypt and Constantinople do not commend themselves because they are not consistent with Indian experience, every effort has been made in this country to diminish, as far as possible, the supposed danger of cholera being exported to other countries. Whenever the disease is declared to be epidemic at any Indian port, the precaution is taken to inspect all passengers and crews before departure. Information has been regularly furnished to the Egyptian and Constantinople boards of the exact extent of cholera at all Indian ports, and quarantine has been established at Aden as a complement to the quarantine imposed at Suez. Pilgrims are now all required to take out passports before embarkation. Orders have also been issued with a view of improving the cooking, washing, and latrine accommodation on board pilgrim ships, and rules are now under consideration in connexion with the amendment of the Native Passenger Ships Act for the purpose of introducing other changes, all of which are designed to aid in preserving the health of the pilgrims and to bring the procedure more in accord with the Turkish regulations. When cholera became severe in Egypt, 8 medical officers and 40 hospital assistants were sent from India to attend to the sick and advise on sanitary measures, but they did not arrive till the epidemic had almost ceased.

Quarantine was instituted at Suez in May owing to a slight rise in the number of deaths at Bombay, and although such a proceeding as already pointed out was not warranted by experience, there was at least some pretext for it in the theoretical views on the dangers of importation which were entertained by the sanitary boards. But the maintenance of this quarantine after Egypt had itself commenced to suffer from cholera in epidemic prevalence cannot be justified by any sufficient reason. A full report of the Egyptian epidemic must be awaited before any decided and final conclusions can be drawn from it; but so far as the facts are yet known, they all go to confirm Indian experience in every particular and to show that the action taken by the Government of India in respect of cholera—the execution and encouragement of sanitary works of all kinds, is the only action which can properly be taken by the State. It cannot be too clearly affirmed that measures taken to diminish or arrest disease should be directed not to shut up the *persons* who are suffering,—such measures can only end in disappointment and be productive of endless annoyance to the people,—but to improve the sanitary condition of the *place*.

Suspension of the Contagious Diseases Act.

As regards the cantonment lock hospitals, beyond prohibiting the expenditure of any more money on buildings for this purpose, no definite action has been taken on the report of the special committee which was appointed to consider the effect of the Contagious Diseases Act, and to which reference was made in the last two annual reports. In the presidency towns the continuance of Act XIV. of 1868, the Contagious Diseases Act, was attended with great difficulties. In the town of Calcutta certain action taken under the rules had been declared by the High Court to be illegal, and if the Act were not speedily to become practically inoperative, it seemed essential to make it much more stringent; but after having carefully considered the report, and also the proposals advanced by the Bengal Government, it appeared unadvisable to increase the stringency of the law relating to contagious diseases in India. In order to diminish the risk of creating serious complications both of a legal and administrative kind, the Act was for a time restricted to those parts of the town which are frequented by soldiers, and this modification came into force on the 1st November 1881.

The evils, however, which are inseparable from the operation of any such enactment in this country are very grave. The system of registration and inspection therein provided necessitates an interference with the people in their most intimate social relations, which is in all countries objectionable, but specially so in India, where, owing to native customs and other special conditions, all attempt at such interference is beset with peculiar difficulties and involves a constant risk of oppression and injustice. It must be admitted that even in Calcutta, where the Act has been longest in force, and has been worked more actively than in other Indian cities, specific complaints against the police have been but few; but in a matter of this kind the extent of the evils which exist must always be very imperfectly estimated by what appears only on the surface. The fact that in Calcutta during 1879, when the Act applied to the whole town, 12 women on an average were arrested every day for breaches of the rules shows that these dangers are not imaginary. It has been shown that the Act can never under any circumstances be worked with perfect success in Calcutta unless its provisions are extended to the suburban town of Howrah, containing a population of 104,908 souls, under a separate municipality; and that the effect of such extension and of strict

supervision would be to raise the number of women under inspection to upwards of 18,000, and to increase the expenditure to a very large amount. Moreover, funds are urgently required for more important undertakings. The evil effects of venereal diseases, great as they may be in individual cases, are small in the aggregate as compared with the evil effects of fever, dysentery, and the other ordinary diseases of India, either in respect of the suffering they cause or the influence they exercise on the health and physique of succeeding generations. Sanitary works, more especially works of drainage and water-supply, are much required in nearly all Indian cities and towns to remove very evident local causes of disease, but want of funds is a standing difficulty in the way of their construction. It seemed that the money spent in carrying out the Contagious Diseases Act, no matter from what source it is derived, might with greater advantage be devoted to the construction of such sanitary works and to other measures much more likely to benefit the health of the community at large than any system of lock hospitals. While the evils inseparable from the Act are of a serious and embarrassing character, the benefit derived from it is, on the other hand, very doubtful. In Calcutta, where, during nearly 12 years, a greater effort has been made to attain success than in any other Indian city, the results have been at best unsatisfactory and uncertain and venereal disease has continued very prevalent among the people. In accordance with these views the Act has been suspended in the town of Calcutta with effect from the 15th March 1883, and the question of its suspension in the towns of Madras and Bombay is under consideration. Where the Act has been withdrawn the results are to be carefully watched, and the lock hospitals replaced by a specially organised system of dispensary and hospital relief which shall be strictly voluntary.

Special cholera inquiry.

As Surgeon-Major T. R. Lewis embarked for England on the 29th January 1883, and as he will not return to India, it seems desirable to review briefly the work of the special branch of the Sanitary Department with which he has been for many years so intimately connected, and which with his departure now practically comes to an end, at least in the exact shape which it has hitherto taken. Under the orders of the Secretary of State for War, Dr. Lewis, who was then an assistant surgeon in the Army Medical Department, to which he still belongs, was placed at the disposal of the Government of India in order that he and Assistant Surgeon D. D. Cunningham of the Indian Medical Department might institute and carry on a special inquiry into cholera. For several years they devoted themselves entirely to this object, and the results of their investigations which were published from time to time are well known in the scientific world, and have been of material assistance to the Government in deciding on the practical measures which should be taken in dealing with this disease. In 1875 the scope of their work was enlarged, and they were appointed to be Special Assistants to the Sanitary Commissioner with the Government of India, in which capacity they have conducted several most important inquiries in regard to other diseases besides cholera, such as leprosy, the Oriental sore, and Madura foot, and the value of their labours has been acknowledged, not only by the Government, but also by the medical profession. In June 1879 Surgeon D. D. Cunningham was transferred to the Chair of Physiology in the Calcutta Medical College, and Surgeon Lewis remained as the only Special Assistant to the Sanitary Commissioner with the Government of India. In April 1880, when Dr. J. M. Cuningham, Sanitary Commissioner with the Government of India, was, in addition to his other duties, made also Surgeon-General with the Government of India, Surgeon-Major Lewis's connexion with the Sanitary Department became still more intimate, and he has since that time been largely concerned with the general work of that Department, besides taking up special questions of importance, such as the dietary of jails, his memorandum on which has been of great practical use in dealing with questions concerning the health of prisoners in this country. Surgeon-Major D. D. Cunningham some time ago was placed in a position for which his qualifications specially fit him, and it is a matter for congratulation that Surgeon-Major Lewis also, by his appointment as Assistant Professor of Pathology in the Army Medical School at Netley, is occupying a post for which his abilities and experience render him so well fitted, and where he will still be able to do most important work for India.

Suggestions for improving Indian Stations.

In 1878 it was proposed to publish a new edition of the Army Sanitary Commission's "Suggestions in regard to sanitary works required for improving Indian Stations," and also at the same time to re-issue in a convenient form certain portions of the Report of the Royal Commission of 1863 on the sanitary state of the army in India. The information contained both in this Report and in the "Suggestions" seemed to be less known than desirable, and it was also important in the case of the "Suggestions" to make such alterations or additions as further experience dictated. This work was undertaken and

has been completed by the Army Sanitary Commission. Both volumes have now been received and have been distributed in those quarters where they are most likely to be of practical use—to engineer officers of the military works, to first class municipalities and other local bodies of importance, and also to Sanitary Commissioners and Deputy Sanitary Commissioners. With the extracts of the Royal Commission's Report have also been re-printed Miss Nightingale's Observations on Reports from Indian Stations.

ABSTRACT OF REPORT OF THE SANITARY COMMISSIONER FOR MADRAS FOR 1882.

(Dr. M. C. Furnell.)

European Troops.

Sickness and mortality among European troops.

The strength of Her Majesty's European troops during 1882 was 13,391. The admissions into hospital were only 1,069·4, which is a smaller number than any on record since 1860. The deaths were 10·4 per 1,000, which also is less than any previous year on record, except 1880.

In the subjoined table will be found the ratio per 1,000 of admissions, daily sick, mortality, and invaliding since 1870:—

Years.	Ratio per 1,000 of Strength.			Invalided.	
	Admitted.	Daily Sick.	Died in and out of Hospital.	Change of Climate.	For Discharge.
1870	1,481·5	63·9	19·7	70·4	6·6
1871	1,214·3	56·2	19·1	29·2	12·5
1872	1,352·3	59·7	19·2	26·8	11·2
1873	1,270·8	59·3	18·5	50·6	12·7
1874	1,141·2	57·6	13·4	29·5	8·3
1875	1,696·3	86·9	14·3	60·8	15·5
1876	1,132·9	55·2	16·1	31·9	10·9
1877	1,172·2	58·7	17·2	36·0	10·2
1878	1,379·7	65·8	22·1	36·6	9·1
1879	1,438·7	68·4	16·8	34·3	10·2
1880	1,385·4	68·4	9·9	15·0	8·9
1881	1,164·8	68·2	11·1	18·6	8·8
1882	1,069·4	59·3	10·4		

Of the principal diseases, there were in all 15 cases and 9 death from cholera, of which 11 cases and 5 deaths occurred among troops on the march; 1 case occurred at Bellary, 2 at Secunderabad, and 1 at Madras, all proving fatal. Considering there was a pretty smart outbreak of cholera in the town amongst the civil population of Bellary during the year, it speaks well for the care taken of Her Majesty's troops that they should have escaped with only one casualty.

There were 6 admissions under smallpox, and no deaths.

Under the head of fevers there were 1,928 admissions and 26 deaths. The admissions were less in number, but the deaths considerably higher than last year, which returned only 7 deaths with 2,880 admissions. There were 47 cases of typhoid fever, so entered, during 1882, as against 9 last year. Of these 47 cases no less than 23, or 48·9 per cent., proved fatal. This is an excessive mortality, but, as remarked in previous reports, typhoid fever is not so named until the case begins to assume a grave character. Still, if we put typhoid and remittent fevers together, we get 116 cases with 26 deaths, i.e., 22·4 per cent. of deaths to admissions. The greatest number of typhoid cases are returned from Bangalore, 19 out of the 47, with 7 deaths. Secunderabad has 8 cases with 6 deaths. Under remittent and continued fevers 580 cases were returned with 3 deaths. If the cases were from the same stations that returned the typhoid cases one might feel inclined to discount the mortality under that head, but the returns show that the largest number of cases (122) of continued fever was at St. Thomas' Mount and Thayetmyo (70) with no deaths. By far the largest entry was, as usual, under intermittent fever. Of the grand total of fevers, viz., 1,928, no less than 1,301 were from intermittent fever. Kamptee, as usual, headed the list with 373. During the five years ending 1882 the admissions under intermittent fever numbered 11,007, but only one death was recorded.

Dysentery and diarrhœa made up between them 967 of the total admissions, but were accountable only for six deaths. The greatest number of dysentery cases (118) were from Secunderabad with one death.

There were 389 admissions under hepatic diseases with 17 deaths. Bellary had 38 admissions with one death only; Rangoon 67 admissions with 6 deaths; Secundera had 62 admissions with 3 casualties.

The entries under venereal diseases were even larger than last year (being in the ratio of 257·3 per 1,000 against 220·9), or any year on record, and afford, as remarked in 1880, "humiliating evidence of the inefficacy of police superintendence to prevent the propagation of this loathsome malady."

Native Troops.

Sickness and mortality among Native troops.

On the 1st Janury 1882 the strength of the Madras Native Army was 30,318; there was an increase during the year from recruiting and other causes of 2,154. There was a decrease by invaliding, discharge, and deaths, &c., of 4,312, leaving a total on the 1st January, of 28,160. Of the above, this office has received medical returns of 23,795 only. The remaining 4,365 are serving beyond the limits of the Madras command. Of this number (23,795) 20,607 were admitted during the year into hospital, the average daily sick being 766·80. There were 359 deaths, 297 in and 62 out of hospital; this gives us a ratio of 15·0 per 1,000, the death-rate of the civil population during the year being 16·2, in Great Britain during the same period 19·5.

The subjoined table gives in a condensed form the admissions and deaths amongst the Native troops since 1868. It will be seen that, although 1882 compares favourably with the two years preceding as regards number of deaths and daily sick, it compares unfavourably with all other years since 1868. The Madras Army does not seem to have enjoyed as good health during the last three years as it formerly did.

	Ratio per 1,000 of Strength.														
	1868.	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	1880.	1881.	1882.
Admissions	707·4	702·5	630·6	693·9	1,067·9	893·3	772·7	777·7	726·8	832·2	793·2	1,061·2	1,275·9	948·7	866·0
Daily sick	29·0	29·3	26·4	26·9	34·7	31·5	30·0	30·7	28·2	28·8	29·7	40·4	55·8	44·8	32·2
Deaths in hospital	8·6	10·1	9·4	8·8	9·9	6·2	7·7	9·0	9·8	11·3	11·7	11·8	12·3	13·2	12·4
Deaths out of hospital	1·4	3·6	3·6	1·3	2·4	1·2	2·0	1·3	1·3	1·7	1·6	2·4	2·4	3·0	2·6
Invaliding	16·4	24·5	25·6	23·3	28·4	30·9	33·5	39·3	37·4	30·5	52·6	38·9	37·8	47·0	39·6

The principal causes of sickness were, as usual, fevers 8,459, skin diseases 2,855, bowel complaints 1,268, rheumatism 796, and venereal diseases 538.

The greatest number of deaths was under the head of cholera. There were altogether 113 cases of cholera returned with 65 deaths. Of these, 70 cases occurred at Vellore with 45 deaths. Bellary had 11 cases with no deaths, an almost unprecedented occurrence.

Among the 8,459 admissions under fevers, 61 deaths occurred. There were 38 deaths from intermittent fever amongst the 7,999 admissions. It has been pointed out in a previous page that, in five years, amongst 11,007 admissions in European troops, only one death was registered. The native sepoy feeds himself, and often very indifferently, from the number of followers dependent upon him. The British soldier is carefully fed in hospital.

There were 28 cases of smallpox with two deaths, as compared with 33 admissions and three deaths last year.

Jails.

Sickness and mortality in jails.

From the returns furnished to this office we find that the average strength of all jails during the year under review was 8,803, and that the total admissions into hospital were 7,046, the average daily sick being 253·55. Of these admissions 369 or 5·2 per cent. died, about the same as, but slightly less than last year.

Fevers, as usual, contributed the greatest number of admissions. There were 2,402 under this head out of a total of 7,046; of these, 2,075 were fevers of an intermittent type, by far the largest number as usual from Rajahmundry. The deaths from this large admission were, however, very few—6 in all, viz., 1 remittent, 2 continued, and 3 intermittent—bearing out the remark made elsewhere that these fevers are very amenable to treatment if only the patients, as in jails, could be made to submit to it.

Cholera was answerable for 54 admissions and 29 deaths. Considering that cholera was more or less epidemic during the year in many of the districts in which jails are situated, the mortality cannot be considered very heavy. The greatest number of cholera cases—34 admissions with 23 deaths—occurred in the Coimbatore jail, and the

outbreak there, very sudden and somewhat violent whilst it lasted, was of a most singular character. There was no cholera at the time either in the town or its neighbourhood. Not the faintest clue could be obtained of communication with any person or thing coming from an infected locality. The first man attacked had been in jail since 1877, and had no friends to visit him since 1880. The jail was scrupulously clean. It was soon perceived that certain inmates of the jail, the women, civil debtors, and juveniles entirely escaped. The food supplied to the prisoners came from the same source, was supplied from one contractor, but it was discovered that whilst the adult male prisoners who were attacked obtained their drinking water from wells within the jail, especially one large well in block No. 5, the women, children, and civil debtors were supplied from a well more conveniently near them just outside the jail gate, but inside the jail compound. The prisoners were moved into camp within the large jail compound and water obtained from a source outside, and the epidemic soon after ceased. There were 34 seizures in all, of whom 23 died. The strength of the jail at the time was 936.

This is one of those curious outbreaks that almost defy explanation. I visited the the jail at the time of the outbreak several times with the Medical Officer in charge, and the explanation which suggested itself to my mind was that the cholera was most probably dependent on the drinking water, for, as remarked above, it was noticeable that the blocks which escaped were supplied from a different well. The principal well inside the jail is in No. 5 block, and, although there are other wells, it is from this well chiefly the water-supply for the prisoners is drawn. But how, it may be asked, did cholera then suddenly make its appearance in a jail scrupulously clean, and the hygienic conditions of which are most carefully attended to? This is of course a most difficult question to answer, and the answer at best can be but problematical, but this is the solution which presents itself to my mind. The wells inside the jail are of course fed by percolation from the surrounding soil. There was an epidemic of cholera in 1877, and there was also an isolated case in 1880; the excreta as usual were buried in the large compound; the spot was pointed out to me and is depicted in the map. During 1882, in the months of June and July, there was an unusual downfall of rain. The south-west monsoon was very heavy, and even Coimbatore, which does not usually receive much rain, was visited by copious showers. May it not have occurred that some old deposit of cholera dejecta was tapped by the unusual rainfall, and found its way into the well or wells? The well which supplied the women and juveniles was far away on the other side of the jail and on higher grounds than the wells inside the jail.

General Population.

Vital statistics.

The registration of births and deaths is, in municipalities, carried on by a registrar paid for that purpose, and the figures are fairly correct. In non-municipal towns and villages this duty still devolves on the Kurnam, and the figures are comparatively unreliable. The civil medical officers have been made also sanitary officers of their respective districts, and will, from 1st April 1883, be called upon to scrutinise the returns of births and deaths. We may for the future, therefore, look for more reliable results.

The total births registered were 751,104, giving a birth-ratio per 1,000 of 26·0. This is even higher than last year, which gave 25·5 per 1,000, and is higher than any previous year recorded. As previously remarked, this may be taken not only as evidence that the fecundity of the people so cruelly repressed by the famine has returned to its normal state, but that the prejudice against registration, especially of births, which exists among the native population, is, in some measure, disappearing. There were 384,989 males borne to 366,115 females, showing a ratio of 105·1 males to 100 females.

During 1882 there died 470,700 persons out of a population of 28,887,111, giving a death-ratio per 1,000 of 16·2. This, if reliable, points to a lower death-rate than obtained in the United Kingdom for the same year, viz., 19·2. There died 243,819 males to 226,881 females, being a ratio of 107·4 male to every 100 female deaths.

The death-rate in towns amounted to 23·2 per 1,000, and in districts 15·9; last year the figures respectively were 22·8 for towns and 15·8 for districts. The increase was due to the mortality from cholera; still the numbers compare favourably with the average for the five preceding years, exclusive of the famine year, viz., 26·5 and 20·0 per 1,000.

The mortality according to classes was as follows:—Native Christians 18·8, Muhammadans 17·4, Hindus 16·1 per 1,000. In Ganjam, as usual, and South and North Arcot, the mortality amongst Native Christians seems very slight, 6·2, 5·6, and 9·3 per 1,000 respectively.

The table given below, showing the deaths from different causes, demonstrates that 1882 was a more sickly year than its two immediate predecessors, and this was the case

not only from cholera, of which disease there died 23,604 compared with 9,446 in 1881, but also from smallpox, of which pestilence 20,159 deaths are recorded against 15,776 of the previous year. In fevers there is a considerable falling off.

Years.	Total Deaths.	Cholera.	Smallpox.	Fevers.	Bowel Complaints.	Injuries.	Other Causes.
1866 - - -	609,106	209,961	23,106	110,102	—	9,047	256,890
1867 - - -	372,026	33,205	27,907	112,511	—	8,613	189,790
1868 - - -	390,959	8,036	34,330	105,692	—	9,242	233,659
1869 - - -	451,981	21,034	17,448	132,346	—	9,310	271,843
1870 - - -	451,020	55,867	11,252	151,027	—	12,325	220,549
1871 - - -	444,371	17,656	20,823	192,469	38,928	15,323	159,172
1872 - - -	501,482	13,247	39,074	214,148	39,387	15,150	180,476
1873 - - -	506,894	840	51,784	222,843	36,392	14,251	180,784
1874 - - -	516,848	313	48,343	226,220	37,993	13,065	190,914
1875 - - -	641,266	94,546	24,775	252,042	37,484	12,421	219,992
1876 - - -	680,384	148,193	23,469	230,092	38,176	11,175	229,279
1877 - - -	1,556,312	357,430	88,321	469,241	133,366	16,460	491,494
1878 - - -	810,921	42,167	56,360	374,443	48,083	15,007	269,861
1879 - - -	549,390	13,296	17,840	285,477	23,218	12,619	196,940
1880 - - -	454,101	613	14,529	209,940	19,622	10,345	198,552
1881 - - -	465,682	9,446	15,776	203,542	18,961	11,527	206,430
1882 - - -	470,700	23,604	20,159	188,564	19,958	11,611	206,807

Cholera. The year 1880 was a year of almost complete freedom from cholera. This immunity continued during the first three-quarters of 1881; towards the end of that year cholera invaded the Madras Presidency, making its appearance in October at Tirupati. The year 1882 commenced with this legacy from its predecessor, and during the whole year up to its close cholera has more or less existed on the south-eastern portion of the Presidency. The districts principally affected have been Madras, Chingleput, South and North Arcot, Trichinopoly, Tanjore, Madura, and Tinnevelly; of the municipalities, Madras, Cuddalore, Trichinopoly, Kumbakónam, Negapatam, Madura, and Salem. The total number of deaths returned from cholera during 1882, including districts and municipalities, was 23,604, giving a death-rate of 0·8 per 1,000 of population. The average of the previous five years, excluding the exceptional year 1877, being 1·5. The rate per 1,000 in municipalities being 2·1.

It will be seen, however, by a glance at the above table, that although 1882 is a year of greater cholera mortality than the three previous years, it compares favourably with many former epidemics.

Smallpox. The deaths from smallpox during 1882 exceed any since 1878. There were 20,159 deaths registered under this head compared with 15,776 for 1881. If we classify the districts according to numbers of deaths, we find, as usual, Ganjam heading the list, followed in order of succession by North Arcot, Coimbatore, Malabar, and South Arcot. Last year it was Ganjam, Tinnevelly, North Arcot, Madras, and Chingleput. This year Madras and Chingleput stand low down in the list.

As usual by far the largest number of victims of this loathsome malady were children under 12 years of age. More than two-thirds were from this class—13,999 out of a gross total of 20,159; and quite 23 per cent. of the whole number were infants in arms under one year of age.

Fevers. The deaths registered from this cause were not as high as usual. Out of a gross total of 470,700 deaths in 1882, fever claimed only 188,561, as against 203,542 for 1881. This diminished number, however, represents more than twice as many casualties as were registered under the other four heads put together, viz., cholera, smallpox, bowel-complaints, and injuries.

If we total up the number of deaths returned under the head of fever for the past 14 years, we get the appalling number of 3,269,522, whilst cholera, which creates much more fear and alarm, gives us only 787,684, and smallpox 464,124. Fever seems an ever-present evil, and, as pointed out in last Annual Report, no doubt a great number of cases are amenable to simple treatment if only the poor people could avail themselves of the help held out to them by a benevolent Government. We can only hope that time and education will gradually instil into the minds of the people more correct sanitary views as regards household surroundings and drainage, and overcome the cruel belief in Kali and Mariamma, which at present lead so many of the poor to prefer death to treatment.

There was a slight increase in deaths under bowel complaints, attributable, no doubt, to the diarrhœa which generally accompanies cholera epidemics. Bowel complaints.

Vaccination.

The total number of persons vaccinated during 1882 was 661,133, and therefore 59,911 in excess of the operations in 1881. Of the total vaccinated, 649,485 were primary cases, and 11,648 revaccinations. In all the districts except Tanjore and the Nilgiris, there was more work done than in 1881, but these two collectorates show a falling off to the extent of 6,997 and 660 operations respectively. The increase in the several districts is said to have been due to a greater interest in vaccination having been manifested by Revenue officials, and to increased zeal on the part of vaccinators. The presence of smallpox in various quarters is also stated to have given an impetus to vaccination, although sometimes it has an opposite effect. The decrease in the Tanjore district is attributed partly to the discharge of some temporary vaccinators, and partly to the small proportion of the population remaining unprotected. As, however, the number of vaccine operations in 1882 was 37,766, and the number of registered births 61,875, it is very obvious that vaccination was not pushed as it should have been. Of the 649,485 cases of primary vaccination, 601,918 were successful, giving a percentage of success of 92·6 against 91·1 in 1881. On referring to the results of previous years, it appears that there has been a gradual improvement in the percentage of success. The number of revaccinations was 11,648 against 10,541 in 1881. In this class of operations the rates of success were for the two years 45·8 and 65·06 respectively.

In all the districts and municipal towns the numbers of males vaccinated were in excess of the operations on females. At present there are only nine female vaccinators at work, and of these seven belong to municipalities.

Infantile vaccination, although showing an increase to the extent of 18,642 as compared with the results of 1881, was still very backward. The number of children under one year of age vaccinated varied in the districts from 16,095 in Coimbatore to 176 in Malabar. Obviously there is still great room for improvement in this direction.

The agents at work in carrying on vaccination were the same as in former years, but no returns were received from Railway Apothecaries. The number of operations performed by medical subordinates was 4,013 in excess of that for 1881, but in some instances their efforts to push vaccination were followed by a falling off in the numbers of out-patients at dispensaries. Dr. Laing reports that the work of the deputy inspectors showed an improvement, although it was still not very satisfactory.

The average cost of each successful case of vaccination was annas 4 and pies 6, being 3 pies less than 1881.

As regards the progress of vaccination, Dr. Laing observes: "In the districts in which the vaccinators have received great help" from the Revenue officials "the result has been "an increase in the number of cases vaccinated, as is seen in the Coimbatore and Bellary "districts."

Sanitary Works.

Sanitary reports were received from all the towns except Madras. No material change has been made in the system of drainage or conservancy since last report. In Vellore some V-shaped drains were built; in Tinnevelly and Vizagapatam some improvements were effected in drainage; and in Wallajapet and Ongle arrangements were being made for improving house drainage. In regard to conservancy, some improvements were made in the disposal of night-soil and street sweepings. In Coimbatore the night-soil, instead of being buried as hitherto, is now manufactured into poudrette and sold as manure, and in Cuddapah the street sweepings, which the municipality used to sell annually, is now taken up by a contractor for five years. It is questionable, however, if the letting of the collection of street sweepings on contract is an improvement.

In Karur and Masulipatam the number of latrines was increased, but in the latter town they are not freely resorted to by the people, and in four other towns—Calicut, Ootacamund, Negapatam, and Vizagapatam—improvements are reported in their conservancy arrangements.

A pure and wholesome water-supply is of the first importance for the well-being of a community, and it is satisfactory to note that from the reports received an improvement is observable in this, one of the most important objects of sanitation. The principal sources of supply, which used to be left to the mercy of the ignorant people to be polluted in every possible manner conceivable, are now better guarded from pollution.

In most of the towns some tanks and wells and other sources yielding good water are selected and set apart solely for drinking purposes; watchmen are placed over them, and the washing of bodies, clothes, &c., and the use of dirty vessels are strictly prohibited. The poorer and more ignorant of the inhabitants may no doubt consider this to be a hardship, but as time passes on, and if the rules be strictly enforced, they will perhaps come to see the advantages derivable from the use of unpolluted water for drinking and domestic purposes, and the evils arising from the defilement of tanks and wells by washing their dirty bodies and clothes in them and using dirty vessels for drawing water.

The total estimated income of all the towns, exclusive of Madras, was Rs.15,96,920, being an incidence of R. 1-5-0 per head of population. In 1881 the income was Rs. 14,73,234, and the incidence R. 1-3-4 per head. Rs. 4,95,536 were set apart and sanctioned for sanitary purposes, being 22,884 in excess of 1881–82. The percentage of the allotment to the income was 31·0.

Taken as a whole, this appears to be a fair percentage, but only Rs. 3,57,486, or 22·3 per cent. of income, has been expended in the nine months ending December 1882, leaving Rs. 1,38,050 to be spent in the following three months of the year 1882–83. Compared with the preceding year (*i.e.*, taking the corresponding nine months ending with December), the expenditure in 1882 is in excess by Rs. 5,270.

Sanitary reports for 1882 were received from all the Local Fund Circles. There is nothing particular to note in water-supply, drainage, and conservancy, no very great change having been made since last report. Year after year some improvements are being made, though very gradually. Out of a total of 47,250 towns and villages, exclusive of municipalities, in the entire Presidency, only in 640 of them were there scavengering establishments employed against 639 in 1881, these being situated chiefly near cusbah stations and around divisional head-quarters: the more numerous far off villages do not enjoy the privilege. No material improvement has been made in conservancy during the year under review. In 15 circles the benefits of conservancy were extended to a few additional towns and villages, but not to any appreciable extent, the increase in the number ranging from 1 to 7. In six circles a retrograde movement has been made by a reduction in the number of towns and villages conserved; notably so in Madanapalle, where the number at first was reduced from 43 to 28, and then, when funds were becoming low, the establishment even in these was discontinued; in Dindigul the number has been reduced from 15 to 5, in Penukonda from 22 to 13, in Madura from 18 to 9, in Tanjore from 43 to 38, and in Trichinopoly from 22 to 18. All this was owing to want of funds, and it has not unfrequently been noticed in the reviews of Local Fund budget estimates by the Sanitary Commissioner that, when a paucity of funds occurs, it is sanitation that suffers the most, and also it has sometimes been observed that the allotments under other heads have been increased at the expense of the sanitary grant. Thus in the report of the Tanjore Circle, accompanying the budget estimate for 1883–84, the following reasons are assigned for making conservancy of towns and villages the victim of retrenchment owing to want of funds under "General Funds":— * * * "These establishments (conservancy) have to "work almost without supervision, and are of very questionable benefit. At the utmost "they only remove dry rubbish in the streets, and that not constantly or completely, "leaving the backyards and house enclosures, whence danger arises, quite neglected. "They are too weak to produce any real effect on the sanitary condition of the villages, "and when forced to retrench, the Local Fund Board think they cannot select an item "which can better stand reduction." * * * And again, in the report of the Tinnevelly Circle, the President remarks that the great reduction of nearly Rs. 6,000 in the sanitary allotment (chiefly in the improvement of water-supply and village sites, two of the most important objects of sanitation) for 1883–84 was made to meet the "extraordinary demands for education."

It is to be hoped that this state of things will soon pass away, and the evils complained of be remedied, a new era in the sanitary administration of the Presidency having now commenced. While this report was under preparation the long contemplated scheme, by which sanitation and vaccination in districts were to receive more professional attention and European supervision, has been sanctioned. The Zillah or Civil Surgeon will henceforward be the Medical and Sanitary Officer of a district, aided by an Assistant Surgeon to attend to the head-quarter medical duties during his absence on inspection work.

The sanitary works executed during the year were of a nature similar to those carried out in former years. The aggregate available income—one third land-cess—amounted to Rs. 13,41,991, being Rs. 9,408 less than that for the preceding year, 1881. Of this sum Rs. 3,74,689 were sanctioned for sanitary purposes, exclusive of the provision made

for the construction and repair of markets and slaughter-houses. The allotment is less than that for 1881 by Rs. 12,270, and yields a proportion of 27·9 per cent. of available income against 28·7 in the preceding year. Eliminating Malabar and Canara for reasons given in the two preceding reports, the percentage varied from 11·3 in the Madanapalle Circle to 66·0 in Guntur. This circle always heads the list in its sanitary grant, and in it, next to Coimbatore, the largest number (51) of villages is conserved. In Tanjore (64·1), Negapatam (58·8), and Ellore (52·9), the percentages are also high. In eight circles the percentages are between 30 and 45; in nine they are between 20 and 30; and in nine others below 20.

Of the total sanctioned sanitary allotment, Rs. 3,74,689, only Rs. 2,11,192 were spent in the nine months ending with December 1882, leaving Rs. 1,63,497, or more than one-third, to be spent in the following three months. In some circles more than one-half and in some others more than one-third were left unexpended at the end of the year.

General Remarks.

During 1882 the following districts were visited by the Sanitary Commissioner:—Coimbatore, Trichinopoly, Madura, Tinnevelly, Tanjore, South Arcot, Pondicherry, Chingleput, Bellary, Anantapur, Kurnool, Ootacamund, Madras, and by the Deputy Sanitary Commissioner—Godávari, Kistna, Nellore, Bellary, Anantapur, Malabar, Cuddapah, North Arcot, and Coimbatore.

Considerable progress has been made in sanitation in the various municipalities and small towns under Local Fund Boards. This is more marked in some districts than in others, and depends much on the interest taken in such matters by presidents and vice-presidents. But a public feeling in this matter outside mere official circles has unquestionably arisen, and, in my tours, I meet many intelligent native gentlemen giving a considerable portion of their time and energies to municipal matters. In some districts, Madura and Bellary for example, sanitary associations have been started by the inhabitants of towns, not quite large enough to claim the honour of a municipality, and, by this agency, improvements in drainage, scavengering, water-conservancy, and lighting are being carried out. The movement is still in its infancy, but it is a movement in the right direction, and will, no doubt, if fostered, in time develop into a most useful agency of sanitation. In one district, Anantapur, an admirable system of inspection and entry in a diary has been inaugurated by the Collector. Each day the medical officer (who will now by G.O., No. 391, of 22nd February 1883, P.D., be also the sanitary officer) inspects a portion of the town and enters in his diary the notes of his inspection, making any suggestions for improvements he may consider necessary. This book is passed on the same day to the tahsildar, or whoever may be the principal executive officer of the town. This official at once orders or sees carried out what is necessary to remedy the defects pointed out. Once a month this diary is sent to the divisional officer, who enters his remarks and passes it on to the president. In the meantime a second book has been commenced by the medical officer, which at the end of the month is, like its predecessor, passed on to the divisional officer and president, the first book having been returned with such orders as the president may have seen fit to pass. By this means a constant system of sanitary inspection is maintained, most beneficial for the towns concerned. Anantapur, Gooty, and Tadputri being three of the cleanest places I have yet inspected.

I have continued to devote much of my attention to the state of the water-supply of municipalities and towns, convinced that in that direction our energies should, for some time yet, be mainly directed. Without decently wholesome clean water to drink, it seems to me all our other reforms are almost nugatory.

In April 1882 I delivered, by invitation, a lecture on "Water and its connection with the public health" before the Indian association at Patcheappa's Hall. The lecture was a simple exposition of the great defilement water undergoes at the hands of the people in this country, and the danger arising therefrom to the public. In this lecture I quoted at length a number of extracts from the Shastras and writings of Menu, showing that the custom, so common amongst the people, was in direct variance with their own religious teachings. Shortly after its delivery I received a letter from that enlightened ruler, the Maha Rajah of Travancore, expressing his high approval of the lecture, and informing me he had ordered it at once to be translated into Malayalam, and printed at length in the Official Gazette of Travancore. Soon after came a letter from Mr. Anderson, Collector of Bankura, in Bengal, asking permission to have the lecture translated into Hindee at his own expense and "sown broadcast over the land" (meaning Bengal, I presume). This gentleman remarks, "You have hit the nail on the head; the people will believe their own Shastras but not our western views of sanitation." Subsequently,

Colonel Sladen, Commissioner of Akyab, in Burmah, requested permission to have it translated into Burmese, and, with much public spirit, offered a reward of Rs. 250 for the best translation. The lecture has also, quite unsolicited on my part, been translated by independent people into Tamil, Telugu, Canarese and Urdu, and Mr. Higginbotham, the public-spirited bookseller in Madras, has published it in English at his own risk. The Government of Madras were subsequently good enough to allow the Tamil and Telugu translation to be printed at the Government Press and distributed to all municipalities and Local Fund Boards. In some places, in my recent tours, I have found some of these extracts from the Shastras hung up on boards in conspicuous places near the tanks.

It will be seen, from the above, that I am perhaps not overstating the case when I say that some public feeling in the matter has unquestionably arisen, and, it is to be hoped, that as sanitary associations spread, this feeling will become more developed.

But the water question, simple as it looks on paper, is a very difficult one to deal with. The dirtiest tanks in Southern India are many of them the holiest and most sacred, to which crowds of pilgrims resort on certain high feasts and festivals to bathe and wash away their sins. These places, many of which have not been cleaned out in the memory of man, have a reputation such as was enjoyed of old by the pools in India. In this "Teppa Kolam" you are gravely informed a certain rajah bathed and was cured of leprosy; hundreds of barren women have become happy mothers from washing therein; people possessed of evil spirits after dipping have been restored to their senses, &c. It is no use arguing against these "facts"; they are presented to us with the irresistible force of tradition and firm religious belief, and one must, even if not agreeing, at any rate treat with respect beliefs which are or have been common in all ages. But still, I think, I perceive that many Brahmin gentlemen, vice-presidents, and others, not priests, are inclined to admit that perhaps the miraculous virtues of these holy tanks would not be destroyed if they were periodically cleaned out and allowed to become filled with pure water.

During December 1882 I visited, with the permission of Government, the French Settlement of Pondicherry, to examine the system of artesian wells there.

I may here briefly recapitulate the impressions left upon my mind from the visit. We have presented to us a town, furnished with what must be considered the most essential necessary of a tropical city—an ample supply of clean water. There are no less than 14 artesian wells in the place, some 10 of which belong to the public. There is, besides, a supply of water conducted from a distance and laid on with pipes in the city. In every street you see hydrants with stop-cocks from which the people draw water; there are no tanks. Cholera, during 1881-82 and commencement of this year, 1883, has twice swept past Pondicherry, playing sad havoc in the towns of South Arcot contiguous to the French territory, viz., Cuddalore, Porto Novo, Villapuram, Chidambaram, Negapatam, &c., and yet has never effected a lodgement in Pondicherry. It has also visited the towns lying on the same littoral and apparently enjoying the same localistic influences. It may be possible for those who entirely disbelieve in the water contamination theory to account for this on other grounds, but certainly at first sight it seems difficult. The evidence, although striking, is, I am aware, not conclusive; but at any rate, it adds one more to the many accumulating facts on this interesting question.

It is a matter of congratulation that many of our municipalities are bestirring themselves energetically in the question of a pure water-supply, and that some, noticeably Negapatam, are apportioning a part of the revenue to construct artesian wells.

LIBRARY OF THE BOMBAY BRANCH OF THE ROYAL ASIATIC SOCIETY.

ABSTRACT OF REPORT OF THE SANITARY COMMISSIONER FOR BOMBAY FOR 1882.

(Mr. John Lumsdaine.)

General Population.

The number of births registered in 1882 was 491,346, and of these births 255,927 were male and 235,419 were female. In 1881 the registered total was 459,657, and by sexes the numbers were respectively 239,912 and 219,745. For the nine years from 1872 to 1880 inclusive the mean registered total is 310,004; thus made up of 163,194 males and 146,810 females. The total births for 1882 is higher by 31,689 than that for 1881, and it exceeds by 181,342 the mean total for the previous nine years. The general birth-rate for the year was 29·86 per 1,000 of population. For male births it was 30·12, and for females 29·59. In 1881 the general birth-rate was 27·93. For males it was 28·23, and for females 27·62. The general annual mean for the previous nine years ending with 1880 is 19·10 per 1,000 of population enumerated at the census of 1872. The general birth-rate for 1882 is higher by 1·93 than that for 1881, and it also exceeds by 10·76 the mean rate for the previous nine years ending with 1880. It is satisfactory to notice here the general improvement in the registration of births generally. The proportion of male to female children born was 108·71 to 100; last year it was 109·18, and the mean total for the previous nine years was 111·16. In every 100 births there were 52·09 males and 47·91 females, and for every 100 males there were 91·98 females. In 1881 there were 91·59 females for every 100 males, and the mean for the previous nine years was 89·96.

The number of births registered in 1881 and 1882 in each division and district exceeds the mean number for the previous nine years. But taking the number registered for each division in 1882, and comparing it with that for 1881, it is seen that in four out of five divisions the number recorded in this year is higher than that for last year. The one that represents the lower number is Gujarát. In this division, with the exception of the Surat district, in which an insignificant increase of 166 births took place during the year under review, all other districts show less number this year than in the previous year. In 15 out of 24 districts the number registered for this year was higher than that for 1881. The districts in which less number were registered are:—Kánara 12,625 against 13,264, Bombay City 15,094 against 16,381, Thána 25,898 against 26,442, Broach 9,342 against 10,033, Kaira 26,441 against 30,174, Panch Mahals 6,813 against 8,226, Ahmedabad 23,392 against 24,912, Hyderabad 8,767 against 9,398, and Thar and Párkar 5,061 against 5,492.

In Bombay City, Hyderabad, and Shikárpur the birth-rates were lower than the death-rates in this year; in all other districts they were higher. In 1881 the birth-rates were lower than the death-rates in Bombay City, Hyderabad, Broach, Ahmedabad, and Kurrachee. In 22 out of 24 districts the mean annual birth-rate for the nine years ending with 1880 is below the mean annual death-rate for the same period. The most notable instances in this year as regards birth-rates higher than the death rates are—in Ahmednagar they are, respectively, 39·12 and 19·54, in Sholápur 34·57 and 18·99, in Sátára 39·06 and 22·62, in Dhárwár 41·06 and 22·58, and in Kaládgi 35·52 and 19·10. For the Presidency the birth and death rates are, respectively, 29·86 and 20·87. Prior to this year only thrice—in 1874, 1880, and 1881—has the birth-rate exceeded the death-rate.

Amongst the civil population the total deaths recorded in 1882 was 343,418. By sexes there were 181,835 of males and 161,583 of females. In 1881 the registered number was 381,450—202,166 of males and 179,284 of females. The mean number for the preceding nine years from 1872 to 1880 was 395,281. The computed death-rate per 1,000 of population was 20·87, and for 1881 it was 23·18. For the nine years ending with 1880 the average was 24·35; so for 1882 it was less by 2·31 than for 1881, and by 3·48 than the mean for the previous nine years ending with 1880.

By districts, the death-rates ranged from 26·16 in Bombay City to 9·90 in the Upper Sind Frontier. In 1881 the maximum ratio (37·91) was in Broach, and the minimum (6·56) in the Upper Sind Frontier. This year the greater number of deaths (27,304) is

for the Khándeish district, and the least number (1,230) for the Upper Sind Frontier. In 1881 the extremes were, at the same districts, 30,661 and 815.

Except in Bombay City and Shikárpur the death-rate for males everywhere exceeded that for females. In 1881 it was exceeded in Bombay City and Thar and Párkar.

In Sátára, Hyderabad, Thar and Párkar, Shikárpur and Upper Sind Frontier, the recorded number of deaths for the year was higher than that for 1881, and in other districts it was lower. Taking the death-rate in each district for 1882, and comparing it with the mean death-rate for the period of nine years ending with 1880, it will be seen that it is higher in Kolába—19·07 against 15·50, in Kurrachee 18·40 against 15·18, Hyderabad 14·58 against 11·14, Thar and Párkar 17·20 against 9·93, Shikárpur 20·87 against 10·18, and in Upper Sind Frontier 9·90 against 8·45. In Shikárpur district the death-rate this year exceeds double the rate for 1881 and the mean for the preceding nine years. In this year it was 20·87 against 10·17 in 1881. The mean rate for the previous nine years was 10·18. The cause of this increased rate, as given by the Deputy Sanitary Commissioners, Sind Registration district, is here given:—"The greatly "increased number of deaths in the Shikárpur district from fever is due to the "inundations, and, as is usual, the greatest number was registered in November." By divisions Sind only shows the higher death-rate in this year than in 1881—17·54 against 13·22. The other divisions show a comparative lower death-rate. It is much lower in Gujarát this year than in 1881—22·20 against 31·39. On comparing the death-rate of this year with the mean death-rate for nine years ending with 1880, it will be seen that out of five divisions Sind only shows a higher death-rate—17·54 against 11·37.

The results of deaths at different stages of life show that in 1882 the ratio of infants under one year was higher than that for 1881—165·92 against 164·69: at other stages it was lower. Taking the mean mortality for the past seven years ending with 1880, there is a remarkable increase of ratio of infant mortality in each of the two succeeding years. The mean ratio for seven years was 108·80 against 164·69 in 1881 and 165·92 in 1882. In other stages there is a considerable decline in the ratio this year, as well as in 1881, than the mean for the preceding seven years. The percentage on total deaths among infants is 22·11 against 19·76 in 1881, among children above one and under 12 years and adults above 12 and under 50 years of age is 57·77 against 59·57, and amongst old people 20·12 against 20·67 in 1881. The percentage on total mean deaths for seven years ending with 1880 was 14·82 amongst infants, 60·28 amongst children and adults, and 24·90 amongst old people.

The subjoined table shows deaths from the specified causes for each year from 1872 to 1882. The mean for nine years ending with 1880 is contrasted with the total deaths from six different causes for 1881 and 1882.

Years.	Deaths by Causes.						
	Cholera.	Smallpox.	Fevers.	Bowel Complaints.	Injuries.	All other causes.	All causes.
1872	15,642	26,699	206,747	33,664	5,804	67,404	355,960
1873	283	9,935	188,201	26,259	5,951	60,343	290,972
1874	37	3,903	183,717	26,990	6,165	57,840	278,652
1875	47,555	3,461	219,156	33,650	6,217	65,679	375,718
1876	32,117	11,817	220,833	33,683	5,928	63,882	368,260
1877	57,252	27,369	336,865	60,257	7,539	138,426	627,708
1878	46,743	4,475	357,376	44,165	7,556	75,642	532,951
1879	6,937	1,156	286,526	26,349	7,107	59,467	387,542
1880	684	940	246,779	24,452	6,082	49,736	328,673
Total	207,250	89,755	2,246,200	306,469	58,343	638,419	3,546,436
Mean for nine years	23,028	9,973	249,578	34,052	6,482	70,935	394,048
Ratio per 1,000 of population enumerated at the Census of 1872	1·42	0·61	15·38	2·10	0·40	4·37	24·28
1881	16,694	539	272,403	30,342	5,950	55,522	381,450
Ratio per 1,000 of population enumerated at the Census of 1881	1·01	0·03	16·56	1·84	0·36	3·38	23·18
1882	7,904	1,630	243,454	28,353	5,913	56,164	343,418
Ratio per 1,000 of population enumerated at the Census of 1881	0·48	0·10	14·80	1·72	0·36	3·41	20·87

The subjoined table shows, year by year, for the period indicated and for each division the registered deaths from cholera; and the totals for the year 1882 are so placed as to contrast with the means of the previous 16 years. Cholera.

Divisions.	Population by Census of 1881.	1866.	1867.	1868.	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	1880.	1881.	Total for 16 years.	Means for 16 years.	1882.
Northern Deccan	4,252,773	2,872	180	3,820	8,179	719	3,971	10,383	—	2	22,151	4,431	11,444	15,890	578	530	10,001	95,151	5,947	1,309
Southern Deccan	3,447,764	18,184	90	1,342	23,782	934	338	4,031	123	1	10,055	19,052	30,962	15,163	—	18	1,358	125,433	7,840	4,413
Konkan - -	3,482,325	1,474	327	921	3,430	858	1,457	714	107	19	9,203	2,272	12,900	4,394	1,298	127	2,233	41,732	2,608	1,212
Gujarát - -	2,857,731	488	196	241	9,426	155	55	517	53	15	6,098	6,274	1,946	11,270	920	9	3,102	40,765	2,548	967
Sind - -	2,413,823	9	4,350	23	7,513	—	—	—	—	—	48	88	—	26	4,140	—	—	16,197	1,012	3
Total -	16,454,414	23,027	5,143	6,347	52,330	2,666	5,821	15,642	283	37	47,555	32,117	57,252	46,743	6,937	684	16,694	319,278	19,955	7,904

It will be seen that for the 16 years' period, from 1866 to 1881 inclusive, 319,278 deaths were registered from cholera, and this would give an annual rate of 19,955. With an equable rate, and with the grand total of the last census, out of every 823 persons living *one* died of cholera. Looking at the last line of the table it will be seen that for 10 years the triennial recurrence is unbroken; in the 11th and 12th years the famine was a disturbing factor, and the high number for the 13th year marks it as a recurrent year. The total then falls from 46,743 to 6,937, and in the next year to 684; in the next, however,—the 16th—the wave returns, and the deaths are 16,694. The year under report is not a recurrent year, and the number of deaths falls from 16,694 to 7,904. The ratios per 1,000 living are, respectively, 0·48 and 1·01, whilst the mean for 16 years is 1·31. Out of every 1,000 deaths from all causes there were 23 from cholera.

Of our 285 registration circles in the Presidency, 125 were affected, and the total deaths from cholera amounted to 7,904. These deaths were distributed over 18 districts or collectorates and 831 units of registration. The ratio per 1,000 of cholera deaths to the population of the Presidency was 0·48. Out of the 223 rural circles, 55 town circles, and 7 civil cantonment circles, 98, 24, and 3 were respectively affected. Out of 24,535 inhabited villages, 804 were affected.

The larger number of villages affected during the year was 236 out of 1,340 in the Satara district, and 96 out of 1,073 in the Belgaum district, in the remaining 16 districts the number of villages affected in each was below 65.

All the 5 districts in the Northern Deccan Division were affected, and the attacks and deaths were 3,141 and 1,309 against 22,056 and 10,001 in the preceding year. In the Southern Deccan it prevailed more or less in all 4 districts, and in this division the attacks and deaths were 9,898 and 4,413, respectively, against 3,239 and 1,358. In the Konkan Division, including Bombay City, 4 out of 5 districts (Kánara being exempt) were affected, and 1,212 deaths out of 1,788 attacks were recorded, the figures for the preceding year being 2,233 out of 3,576. In Gujarát also 4 out of 5 districts (Panch Maháls being free from the disease) were affected, and there were 1,845 seizures and 967 deaths; last year they were 6,011 and 3,102 respectively. There were only 4 cases and 3 deaths reported from the Thar and Párkar District of the Sind Division; the rest of the Province of Sind kept exempt during the year.

In 1882 the registered deaths from smallpox were 1,630; and, shown by sexes, they were 791 of males and 839 of females against 539 in 1881, which shows an increase of 1,091, and compared with the mean for 9 years (from 1872 to 1880) there is a decrease of 8,343. Smallpox.

Every division excepting Sind, and every district excepting Ratnágiri, Kurrachee, Thar and Párkar, and Shikárpur, showed an increased mortality, while Broach and Upper Sind Frontier were entirely free. In the remaining 18 districts, Poona stood first with a maximum of 506 deaths. Next is Thana with 328, and Khándesh with 131. In 6 districts the number of deaths was above 50, but below 100. In 5 districts the number was above 10 and below 50. In 8 the number was below 10. By divisions the Northern Deccan stood first with a maximum number of 679 deaths, and the Southern Deccan with a minimum of 70 deaths.

The following table shows the deaths for each month, those under 1 year, under 12 and above 12, and it will be seen from it that the minimum mortality was amongst infants under 1 year, and the maximum amongst those above 12 years :—

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Total deaths from small-pox in each month	41	45	66	107	120	146	148	98	81	98	201	479	1,630
Deaths under 1 year - - -	15	7	14	25	25	19	23	17	18	21	31	96	311
Do. do. 12 years - - -	14	10	31	36	40	56	39	29	22	20	63	293	563
Do. above 12 years - - -	12	28	21	46	55	71	86	52	44	57	107	180	756

Fever.

The deaths from fever in 1882 were 243,454 (128,364 males and 115,090 females) against 272,403, thus showing a decrease of 28,949 deaths during the year.

Excepting the Sind Division (especially the districts of Hyderabad, Shikárpur, and Thar and Párkar), the deaths from fever have decreased in every division and in every district. The cause of increase in Sind Division is stated by Mr. J. C. H. Peacocke, the Acting Deputy Sanitary Commissioner, Sind Registration districts, as follows :—

"The greatly increased number of deaths in the Shikárpur district from fever is, I think, due to the inundations, and, as is usual, the greatest number was registered in November. That this month is peculiarly unhealthy in the Shikárpur and Jacobabad divisions is clearly shown, whilst the colder months, December to March, are most fatal in the three remaining districts."

Bowel complaints.

The deaths from bowel-complaints during the year under report were 28,353 against 30,342 last year, showing a decrease of 1,989. By sexes, 15,630 males and 12,723 females died from these diseases. There is a slight increase in the number of deaths during 1882 when compared with those of last year in the Southern Deccan and Sind, and a decrease in the three divisions—Northern Deccan, Konkan, and Gujarát. By districts there is an increase in 11 and a decrease in 13. The highest and lowest ratios are 3·98 in Dhárwár and 0·04 in Thar and Párkar.

Injuries.

There were 5,913 deaths from injuries, of which 3,496 occurred among males and 2,417 among females; the ratio per 1,000 of population was 0·36. For 1881 the total was 5,950, the ratio being 0·36. This shows a decrease in the total of 37 deaths, the ratio being unchanged. Of the 5,913 deaths, 2642 were caused by drowning, 1,277 resulted from snake-bites, 1,245 from causes other than those specified, 361 from wounds, 214 by hanging, 103 by poisoning, and 71 from attacks by wild beasts.

Other causes.

The recorded deaths from causes other than those specified numbered 56,164, of whom 29,286 occurred among males and 26,878 among females. The total for 1881 was 55,522; so for this year there is an increase of 642.

Vaccination.

The following table contrasts the work amongst the civil and military population during the year under report with that for 1881–82.

Establishment.	Persons primarily vaccinated.				Persons re-vaccinated.				Total Number of Persons operated on.			
	1881-82.	1882-83.	Increase.	Decrease.	1881-82.	1882-83.	Increase.	Decrease.	1881-82.	1882-83.	Increase.	Decrease
In Civil Life.												
Itinerant - -	698,169	758,027	59,858 / 8·56	—	51,320	59,947	8,627 / 16·81	—	749,489	817,974	68,505 / 9·13	—
Dispensary - -	26,813	28,770	1,957 / 7·30	—	2,495	2,435	—	60 / 2·40	29,308	31,205	1,897 / 6·47	—
Total - -	724,922	786,817	61,815 / 8·54	—	53,815	62,382	8,627 / 16·03	60 / 0·11	778,737	849,199	70,462 / 9·05	—
In Army Life.												
Native Army - -	3,330	4,487	1,157 / 30·21	—	1,917	3,551	1,634 / 58·80	—	5,747	8,508	2,821 / 49·09	—
British Army - -	571	402	—	169 / 29·60	1,037	542	—	495 / 47·73	1,608	944	—	664 / 41·29
Total - -	4,401	5,389	1,157 / 26·29	169 / 3·84	2,954	4,123	1,634 / 56·36	495 / 16·76	7,355	9,512	2,821 / 38·35	664 / 9·03
Total for the whole Presidency.	729,323	792,206	63,053 / 8·64	169 / 0·02	56,769	66,505	10,291 / 18·13	555 / 0·98	786,092	858,711	73,283 / 9·32	664 / 0·08

It will be observed that there were 792,206 persons primarily vaccinated, and 66,505 re-vaccinated, against 729,323 and 56,769 in 1881–82, showing a net increase of 62,883, or 8·62 per cent. under primary vaccinations, as also a net increase of 9,736, or 17·15 per cent., under re-vaccinations. There was a considerable decrease (41·29 per cent.) under both kinds of operation amongst European troops, the figures being 944 against 1,608 in the preceding year. The rate of increase in re-vaccinations was 18·13 per cent., more than double that in primary vaccinations. On the whole, there has been an increase of 72,619, or, in other words, for every 100 persons operated on in 1881–82, the numbers for this year have been 109·24.

Out of 792,206 persons primarily vaccinated, 761,745 cases were successful, or 96·15; or only 0·37 per cent. below the highest percentage attained in 1881–82 against 95·95 in 1880–81, 95·11 in 1879–80, and 94·53 in 1878–79, thus showing that there was an improvement in the quality and the quantity of the work performed during the year. The number of unsuccessful cases also compares favourably with those of the previous years, though slightly in excess of that in the preceding year, being 14,232 against 14,061, 14,721, 15,178, and 19,425. Secondary operations, after the failure of the first, were performed on 2,219 persons, and 18,528 persons escaped observation.

During the year, 66,505 persons were re-vaccinated against 56,769 for 1881–82. In 68 instances the re-vaccinations were repeated, in 7,342 instances the results could not be ascertained, and in 12,811 it failed. The number of successful cases was 46,420, or 69·80 per 100 against 71·65 in the preceding year.

The total number of persons operated on was 858,711, and of these 808,165, or 94·11 per cent., were successful. In 1881–82 the percentage was 94·72. There were 2,367 persons operated on more than once; the "unsuccessful" numbered 27,043, and the "unknown" cases were 25,870.

The age details are compiled for three stages, viz., those under 1 year, those between 1 and 6 years, and those above 6 years. The numbers under each stage primarily vaccinated were respectively 485,661, 284,141, and 22,404 against 479,000, 231,352, and 18,971 during the preceding year. The number of infants successfully vaccinated was 468,594, of children between 1 and 6 years 273,132, and of persons of other ages 20,019. Thus out of every 100 persons primarily vaccinated, there were 61·30 infants, of whom 59·15 were successfully vaccinated against 59·58 in 1880–81, 52·71 in 1879–80, 52·11 in 1878–79, 47·55 in 1877–78, and 42·48 in 1876–77. Thus every year is characterised by a progress in the protection afforded to infants. When compared with the preceding year it is, however, lower by 0·43; but this is only apparent, because the difference between the numbers vaccinated and the successful cases remains unaltered in both years.

The rate of protection was higher than last year in all the districts and circles, except in Sind and Aden. It was lowest in Konkan and Aden, &c. In British and Native territory it was respectively 29·89 and 29·46 against 26·90 and 28·53 per 1,000 of population in the previous year. On the whole, 29·74 persons of all ages per every 1,000 of population, against 27·54 last year, 24·60 in 1880–81, and 22·26 in 1879–80, were primarily vaccinated successfully.

Animal vaccination was carried on in Bombay, Poona, Poona Cantonment, Broach, Nadiád, Anklesvar, Hánsot, and Kurrachee. In Kurrachee it has been discontinued since July last.

The total cost of vaccination for the whole Presidency, including all charges, was Rs. 2,68,285-13-3½, and the successful cases, excluding dispensaries and the army, were 773,192. The average cost per each successful case was annas 5-7, or 3 pies less than last year.

There were 31 Inspectors and 4 Assistant Superintendents on travelling duty. Of this number 27 Inspectors and 2 Assistant Superintendents were paid by Government, and the others by native States. The names of 388,066 children were called from the registers, and 300,827 were present, 86,923 were absent, but known to be absent, and 316 could not be accounted for, as they had migrated. Out of 300,827 children inspected, 288,916, or 96·04 per cent., were protected, and in 11,911 cases, or 3·96 per cent., the operation was unsuccessful. Again, out of 288,916, or 96·04 per cent., successful cases, 195,982, or 65·15 per 100, had "good" cicatrices, 59,573, or 19·80, "middling," and 33,361, or 11·09, "bad." In the registers tested the results were entered as 367,585 successful, 10,241 unsuccessful, 11,139 unknown or absent, and 899 secondary operations. Excluding the unknown and secondary operations from calculation, to compare this result with that of inspection, the percentages of successful and unsuccessful cases are respectively 97·52 and 2·48. The rate of travelling was quicker than last year in the Northern Deccan and Southern Deccan and Western Gujarát, and the number of villages seen

was greater in the Northern Deccan, Sind, and Cutch only. The greatest number of villages seen was in Sind. The number of children inspected was greater in all the districts and circles except the Konkan and Eastern Gujarát.

Taking the work of all the Deputy Sanitary Commissioners, Superintendents, Assistant Superintendents, and Inspectors together, there were 4,811 encampments, 87,620¾ miles travelled in 8,797 days, and 353,753 children inspected in 14,852 villages. Out of every 100 persons operated on, 41·20 were this year inspected, against 43·72 in the preceding year, 46·27 in 1880–81, 43·10 in 1879–80, 45·58 in 1878–79, and 35·53 in 1877–78.

The Compulsory Vaccination Act (I. of 1877) has been in force for five years, and it has worked fairly well. There were 1,343 persons prosecuted under the Vaccination Act, of whom 1,000 were instances of neglecting to have the children vaccinated, and 343 for not bringing the children vaccinated for inspection.

This is the third complete year in which the Kurrachee Vaccination Act (No. IV. of 1879) has been worked in that city, and a great improvement has been effected in the quality of the work performed over that of last year. The total number of persons operated on was 7,160 against 4,655 in 1881–82.

Sanitary Works.

Military works.

The actual outlay on sanitary works (Military) during 1882 amounted to Rs. 1,19,036; of this sum Rs. 37,859 were spent at Ahmedabad, of which Rs. 36,977 were for constructing a hospital for British troops. At Aden Rs. 14,752 were expended, of which Rs. 3,796 were for providing huts for infectious disease cases at Steamer Point; Rs. 2,052 for improving the Sanitarium Hospital at Steamer Point; Rs. 1,020 for re-constructing lower male ward, European Infantry Hospital, and Rs. 3,730 for re-constructing female ward of European Infantry Hospital. At Poona Rs. 13,755 were spent, of which Rs. 5,352 were for improving the slaughter-yard at Wanouri; Rs. 3,199 for converting the old guard-room and cells in the old Horse Artillery lines into quarters for the Farrier Major Assistant at the Poona Army Veterinary School, and Rs. 1,662 for preserving and watering trees that have been planted in connexion with sanitary improvements to Ghorpuri barracks. At Mhow Rs. 12,722 were expended, of which Rs. 1,956 were for constructing 2 wards for contagious disease for camp followers and staff hospital; Rs. 2,170 for providing pipes and cocks to the wash-houses of cavalry barracks and quarter guard; and Rs. 2,747 for fixing pipe in the wash-houses in the European Infantry lines. At Mount Abu Rs. 9,427 were spent, of which Rs. 7,616 were for adding a coat of asphalte to certain of the floors of the military buildings.

Civil works.

Abstracts of reports received from municipalities appear in the Sanitary Commissioner's report, giving an account of the sanitary condition of all municipal towns. The total income of the various municipalities for the year 1881–82 was Rs. 29,19,425 and the sum expended on conservancy by them was Rs. 7,22,280.

ABSTRACT OF REPORT OF THE CALCUTTA MUNICIPALITY FOR 1882-83.

(Mr. H. L. Harrison.)

By Act I. (B. C.) 1882 the Calcutta Municipal year is to extend in future from April to March instead of from January to December. It was during the period covered by this report that the change took effect. On this occasion, therefore, it embraces a period of 15 instead of 12 months. At the same time, wherever desirable, the figures are given for 12 as well as for 15 months, to enable the results to be compared with those of previous years.

The 15 months of 1882-83 have been distinguished by more progress in the direction of town improvements, both structural and sanitary, than has been made in any of the preceding years since the Corporation of the Commissioners was constituted. The measures may be thus summarised—

(1) Extension of the water-supply both filtered and unfiltered.
(2) Completion of the sewerage.
(3) Improvement of the privies of the town, and generally improved arrangements for the removal of night-soil.
(4) Structural improvements of the bustees.
(5) Obliteration of foul and dangerous tanks, and provision of water by other means in bustees, for drinking and bathing purposes.
(6) Measures for surface drainage and surface cleaning in bustees.
(7) Measures for improving cowsheds, which have from time immemorial been centres of filth and insanitation in the bustees.
(8) Structural improvements in the streets of the town.

Water supply.

(1.) *Increase of the unfiltered supply.*—An increased water supply is probably now the most urgent of all the improvements needed in the town. The full benefit of almost every other improvement more or less depends upon it. The present supply is given to the town partly in the form of filtered and partly of unfiltered water, both of which it is projected to extend.

Unfiltered water costs the town about one-fourth as much as filtered water, hence the extreme desirability of increasing the existing supply for all purposes for which it is as useful as filtered water. These are mainly—

(1) Watering the streets.
(2) Flushing the sewers.
(3) Supplying night-soil depôts and connected privies with water.
(4) Supplying water for building purposes, &c.

The demand of the town for water, ever since the filtered supply has been introduced, has gone on increasing year by year without intermission. Hence the amount of filtered water which has hitherto been used in street watering and in supplying latrines, is now urgently needed for domestic consumption. The existing arrangements for supplying unfiltered water are estimated to provide 1¼ million gallons per diem. In the end of 1881 sanction was given to a project for new and more powerful engines at Mullick's Ghat calculated to supply three times as much water as before. During the year 1882, the new site has been taken over and levelled; the engine-house, residence for the Engineer and other buildings, have been taken in hand, and are nearly complete; the machinery and boilers have arrived and have been placed in position, and there is nothing to prevent their commencing work at once, were it not that the arrangements for sinking the well (by which a connexion is established with the river), which were made over to Messrs. Burn and Co., have proved unsuccessful. This *contretemps* cannot be remedied till after the rains, but if the rains leave off early, it is to be hoped that the supply will be in full swing before the close of the current year. The new engines are calculated to deliver 4 million gallons per diem, working six hours a day. They will, therefore, easily supply on an emergency any quantity that can be needed, up to nearly 16 million gallons in 24 hours.

Though the extended supply did not come into operation during 1882, nevertheless part of the benefits were reaped during that year, as the Engineer felt justified in working the old engines longer than he would have done, had they been required for many years more. Thus, as a fact, a much larger supply of unfiltered water has actually been given than in any preceding year, as the following figures show :—

	Daily average of unfiltered water supplied.
	Gallons.
1879	1,091,859
1880	1,165,776
1881	1,257,307
1882	1,838,725
1st quarter of 1883	2,594,276
2nd do.	2,992,494

The last figure is given to show how much the engines have been found capable of doing in the hot weather of the present year. During that quarter the demand for filtered water has been so great that every gallon of it has been economised by substituting for it, wherever feasible, unfiltered water.

The unfiltered piping has been considerably extended throughout the town to enable the supply to be more widely distributed.

Filtered Supply.—The discussions about the extension of the filtered supply have now extended over 4½ years, and they latterly became more and more complicated, owing to a protracted correspondence with the suburbs, and also to the different opinions which were expressed regarding the relative merits of a masonry culvert and an open-cut for conveying the water from Pultah to Calcutta. These discussions have been at last brought to a successful termination, and the Water Supply Committee has presented a report which has met with the entire approval of the Commissioners, the Local Government, and the public. Every effort is being made to give effect to it as speedily as possible, and, when completed, the filtered supply will be increased from eight million gallons to twenty million gallons per diem, of which four million gallons will be at the disposal of the suburbs, and sixteen million gallons at the disposal of the town.

It has been found possible, however, during the past year to increase the supply to a material degree, by putting up a more powerful pump at Wellington Square, and working the engines for half an hour longer. By this means the whole of the water which the main can possibly convey from Pultah has been utilised, instead of running to waste, as a portion of it did formerly. The result of this has been to increase the average daily supply as follows :—

	Daily average of filtered water supplied.
	Gallons.
1879	7,464,159
1880	7,407,256
1881	7,208,453
1882	7,824,576
1st quarter of 1883	8,049,707
2nd do.	8,279,167

Thus the unfiltered supply has been augmented in 1882 by about 48 per cent., and the filtered supply by about 9 per cent., as compared with 1881, and the total supply of water to Calcutta during 1882 has averaged 9,670,709 gallons per diem, or 13 per cent. more than in 1881.

The following description of the quality of the Calcutta water is from the Analyst's report :—

The system of water analysis followed during the past fifteen months, that is, for the first three months of the year 1882 and for the official year 1882-83, has been similar to that carried out during the previous six years. Two methods of analysis are employed; the first a partial analysis which is performed twice in each week, and the second, according to the method of Dr. Frankland, a full and complete process, which is carried out on the water collected on the first day of each month. Two tabular statements are appended to this report, the first giving the summary of the quarterly results of the partial analysis, which figures are taken from the quarterly reports, and the second table embodying the results obtained from the full monthly analysis of the water. To each table the average results for the whole official year are added, *i.e.*, from 1st April 1882 to 31st March 1883, and also for comparison the average results obtained in the previous four or five years by the same methods of analysis are given.

In discussing the quality of the water, it is convenient to divide the subject under two heads; the first and the most important being the chemical quality of the water, and the second the quality of the water as to its freedom from mechanically suspended impurities, *i.e.*, as to the perfection of the filtering arrangements. In Table A., columns four and five deal with the chemical quality, and columns two and three with the physical quality of the water. The average result of the 103 analyses of the hydrant water made during the official year by this method showed that there were 8·88 parts of chlorine and 0·014 parts of total ammonia in every million of water, as against 9·10 parts of chlorine and 0·015 parts of total ammonia found in 1881, so that the quality of the water in the two years was almost equal, though on comparing these numbers with the averages of previous years, it will be noticed that the water delivered during the past year has been very much more free from nitrogenous organic impurities than the water of the years 1877 to 1880 inclusive. This table also shows clearly the marked influence of the seasons on the quality of our water-supply; this is shown particularly in column four, for while in the first quarter of the year 1882 there were only 9·28 parts of chlorine per million of water, in the second quarter, it rose to 13·5 parts, while under the influence of the rains, it fell in the third quarter to 5·75 parts, and as the rains continued somewhat late in October, the amount of chlorine even in the fourth quarter only reached 6·06 parts. In the first quarter of 1883, the amount of chlorine had again risen to 10·01 parts per million. The effect of heavy rainfall on the quality of the water-supply was extremely well marked on one or two occasions during the past year, and one prominent case was referred to in the fourth quarterly report. On two occasions, at the latter end of October, the amount of total ammonia present in the hydrant water increased very largely, the quantity present being about six to ten times as large as usual. This increase in the impurity of the water, so far as could be ascertained, was caused by the flood-water due to an extremely heavy rainfall after a short period of comparatively dry weather. This heavy rainfall varying from 10 to 15 inches at different stations, accompanied a small cyclonic storm which passed into Bengal a few days before the occurrence of the excess of impurity. The effect was, of course, only temporary, and, after a few days, the water returned to the normal state of purity.

The results of the full and complete method of analysis, as shown in table B., also illustrate very clearly the marked influence of the seasons on the quality of the water. This will be best noticed in the column "total solid impurity," where the amounts will be found to be comparatively large all through the hot weather, and even up to 1st June, but that from 1st July up to the end of November, the total impurity is only about one-half of the previous amount; the diminution of the amount of the total solid impurity will be seen to be coincident with the commencement of the rainy season. The numbers which are given in table B. really deal with two classes of impurities, the four columns, organic carbon, organic nitrogen, nitrogen as nitrates and nitrites, and total combined nitrogen, represent either organic matter actually present in the water, or substances derived from the oxidation of organic matter, whilst the other columns deal principally with impurities of an inorganic nature. It is the impurities of the organic class which are the most dangerous in drinking-water, and it is therefore highly satisfactory to notice that the water delivered during the year 1882-83 was exceptionally free from such impurities. This is shown by comparison of the average numbers for the year in these columns with those of previous years; thus the amounts of organic carbon and nitrogen, representing the organic matter actually present, in one hundred thousand parts of water, were 0·053 and 0·035 respectively, as against 0·121 parts of organic carbon and 0·051 parts of organic nitrogen, the average of the previous four years, though from certain reasons explained in previous annual reports, these latter numbers are unavoidably too high. The fact, however, stands clearly marked that the hydrant water of the past year was of exceptionally good quality in this respect. Again, the amount of nitrogen as nitrates and nitrites, representing oxidized nitrogenous organic matter in the water delivered in 1882–83, was 0·021 part, as against 0·029 part, the average of the previous four years. It would, therefore, not appear too much to say that with respect both to organic matter actually present in the water, and to the presence of *oxidized* organic matter, the water delivered in 1882–83 was purer than that of any year since 1878, the first year in which a complete series of analysis of the Calcutta water was made by this process of analysis. The other columns in this table show that in the case of the less important inorganic impurities, the water has not varied much from the average quality; the comparison of the averages in columns 4, 7, 8, 9, and 10, with those of previous years, will establish this fact clearly.

The filtration of the water can be judged from the first three columns of table A., and, at first sight, it would certainly here appear that the condition of things has not been so satisfactory. One way, and perhaps the most precise way, is to express the results in percentages, by calculating the percentage of the days on which the water was analysed, when the water was found to be distinctly opalescent and coloured, when examined in a tube three feet in length by transmitted light. Calculated in this way, the results given in the table A. become as follows:—in 1882–83 the percentage of days on which the water was not perfectly filtered was 34·9, in 1881 it was 29·1, in 1880 it was 28·2 per cent., in 1879 it was 11·7 per cent., in 1878 it was 27·4 per cent., and in 1877 the percentage was 30·8; so that the water of 1882 was imperfectly filtered for a distinctly longer period than in any year since 1877. As pointed out in the fourth quarterly report for 1882, this result appeared to be due to the heavy rainfall accompanying the cyclonic storm above referred to, which naturally produced heavy flood water, or a condition similar to that which obtains during the height of the rains. Usually the water supplied in October is perfectly filtered, but during almost the whole of October 1882, the condition was the reverse. Notwithstanding the large number of days in 1882–83 on which the water was not perfectly filtered, on most occasions the opalescence and colour were of a very slight description, and so far as can be judged by memory, it may be

stated, that in no year was the turbidity less distinctly marked than in 1882–83, and that therefore, after all, the cause of complaint which would be founded on the above percentages could not very well be sustained.

Table A.

	Number of Days on which Analyses were made in Quarter.	Number of Days of Analysis on which the Water was Colourless and Transparent.	Number of Days of Analysis on which the Water was Opalescent and Yellowish, *i.e.*, days on which Filtration was not perfect.	Amount of Chlorine (representing Dissolved Sodium Chloride, &c.) in One Million Parts of Water.	Amount of "Total Ammonia" (representing Nitrogenous Organic Matter) in One Million Parts of Water.
1st quarter 1882	26	26	0	9·28	0·013
2nd do.	25	24	1	13·50	0·012
3rd do.	24	0	24	5·75	0·013
4th do.	28	17	11	6·06	0·019
1st quarter 1883	26	26	0	10·01	0·010
Average for official year 1882-83, *i.e.*, from 1st April 1882 to 31st March 1883	103	67	36	8·83	0·014
Do. do. 1881	103	75	30	9·10	0·015
Do. do. 1880	103	74	29	9·49	0·030
Do. do. 1879	103	91	12	8·50	0·035
Do. do. 1878	103	75	28	8·37	0·034
Do. do. 1877	104	72	32	10·40	0·046

Table B.

Date of Collection of Sample.	Description of Colour, Transparency.	Total Solid Impurity.	Organic Carbon.	Organic Nitrogen.	Ammonia.	Nitrogen as Nitrates and Nitrites.	Total Combined Nitrogen.	Chlorine.	Hardness. Temporary.	Hardness. Permanent.	Hardness. Total.
1st January 1882	Colourless and transparent.	22·80	·071	·032	None	Traces only	·033	0·71	6·25	2·00	9·43
1st February "	Do.	24·30	·054	·039	None	·092	·131	0·85	5·59	3·12	8·71
1st March "	Do.	23·80	·030	·025	None	Traces only	·025	1·10	3·98	2·73	6·71
Official Year 1882-83.											
1st April 1882	Do.	20·98	·051	·054	None	Traces only	·054	1·38	3·58	2·91	6·49
1st May "	Do.	22·40	·045	·040	None	Do.	·049	1·42	4·50	2·21	6·71
1st June "	Do.	24·10	·102	·025	None	·048	·073	1·21	4·54	2·60	7·14
1st July "	Slightly yellowish and opalescent.	12·76	·064	·013	None	·063	·063	1·06	3·33	3·38	6·71
1st August "	Do.	11·20	·045	·014	None	·062	·076	0·53	3·14	4·43	7·57
1st September "	Almost colourless and transparent.	10·80	·036	·025	None	·025	·050	0·43	2·37	5·57	8·14
1st October "	Yellowish and opalescent.	10·30	·049	·031	None	·027	·058	0·57	1·19	5·60	6·75
1st November "	Slightly yellowish and opalescent.	9·40	·078	·076	None	Traces only	·076	0·64	1·00	5·57	6·57
1st December "	Colourless and transparent.	14·20	·065	·059	None	Do.	·059	0·68	1·82	5·75	7·50
1st January 1883	Do.	19·90	·020	·019	None	Traces not measureable.	·019	0·78	3·54	4·03	7·57
1st February "	Do.	21·82	·037	·023	None	Do.	·023	1·00	5·10	2·47	7·57
1st March "	Do.	24·46	·038	·021	None	·032	·053	1·21	5·22	2·21	7·43
Average for year 1882-83 from 1st April 1882 to 31st March 1883		16·91	·053	·035	None	·021	·056	0·91	3·29	3·89	7·18
Average for year 1881		16·87	·135	·053	None	·034	·087	0·94	3·84	4·04	8·71
Do. 1880		17·03	·139	·046	None	·044	·089	0·98	4·54	3·04	7·95
Do. 1879		17·04	·107	·032	None	·016	·068	0·87	3·25	3·53	6·78
Do. 1878		17·30	·111	·054	None	·023	·077	0·87	2·21	2·91	5·13
Average composition of all London waters in 1877		31·00	·169	·024	None	·025	·352	1·80	—	—	19·73

(2.) *Extension of the sewerage.*—From the year 1871 up to the beginning of the present year, the extension of the sewerage, though most costly, has always been looked upon as one of the greatest sanitary improvements of the town. A few professional men of distinction had uniformly opposed the construction of the sewers, but they were overruled by the great consensus of opinion on the other side, as well as by the marked improvement in the health of the town which followed their introduction. Consequently, the Act constituting the present Corporation (section 27), made it obligatory on the Commissioners to complete and extend the works throughout the town, and not to spend less than 1½ lacs per annum on this work without the permission of the Government. Drainage.

Even, therefore, those who question the benefit of the sewers to the health of the town, are bound to admit that the Commissioners are only carrying out a duty imposed upon them by the legislature, and by the legislature esteemed to be a sanitary boon, in completing that system as speedily as their means admit.

The rate of progress is set forth in the following figures :—

—	No. of Houses connected.	Miles of Sewers laid down.	Expenditure.	Fees realised.
1879 - -	846	5·83	1,21,560	3,615
1880 - -	1,073	7·35	1,37,351	5,242
1881 - -	1,597	14·15	1,96,291	7,713
1882-83 -	3,053	20·67	4,19,933	16,138

These figures show a greatly augmented rate of progress during the 15 months under report, even after allowing for the extra period of three months. It is true that it seems to have been attained at a far higher rate of expenditure. The rate of expenditure is not higher than in 1879, but the true explanation is that in 1882–83 an exceptionally large number of first-class works were carried on, the cost of acquiring the land for which was heavy.

(3.) *Improvement of privies and improved arrangements for removing night-soil.*—As very few privies, especially in the northern part of the town, are connected with the drainage, it is evident that their condition, the manner in which they are constructed, and the manner in which they are kept, is of the utmost possible importance so far as affects the sanitary condition of the town. What these receptacles of filth used to be, may be best read in Dr. Tonnerre's report to the Justices in 1868 :—

> Every hut is provided with a small enclosure made of durmah mats, without any protection from the decomposing influences of the rain and sun. That small enclosure is the bath room, if I may so call it, of the residents or parties inhabiting the hut. The accumulations of night-soil found by me and my officers in those little latrines is incredible, and it is surprising really to find that there is a population who can live in the immediate vicinity of such filthy places where decency and cleanliness are so little regarded. These places are not only prejudicial to hygeine, but also do violence to public morals; they are intolerable nuisances to the neighbourhood, and a sure cause of disease. Hundreds of these places of resort exist in each bustee, and in spite of the numerous prosecutions directed against the occupiers of the huts, the night-soil contained in them is very seldom removed.

Such were bustee privies in 1868, and they remained almost untouched till 1877, when the Commissioners availed themselves of the powers conferred upon them by section 244 of the Municipal Act, and organised an establishment for the systematic daily removal of night-soil from all the unconnected privies in the town. Since that year this establishment, composed of from 1,100 to 1,200 mehters, has been steadily at work; but it has been found that the organisation of an establishment is only half the battle. Many of the privies were so constructed that the proper removal of night-soil was difficult, while nearly all were so built that foul liquid used to stagnate in their neighbourhood, and gradually saturate the subsoil, whence it filtered slowly into the nearest ditch or tank. To remedy this it was necessary to demolish all the worst privies, and insist on their reconstruction in accordance with an approved plan. This very important work was inaugurated by the Engineer, Mr. Kimber, to whom the new establishment was transferred in 1877, and it has been carried on without check ever since 1878. In the year under report this Department was re-transferred to the control of the Health Officer, and strengthened by the appointment of two special inspectors and a staff of jemadars to supervise it.

The following figures, giving the number of new privies sanctioned since 1878, will show how much has been done to remedy the evil during those years; of these a few but very few, are not in bustees:—

		No. of new privies sanctioned.	
1878		744	
1879		435	
1880		890	
1881		1,333	
1882	1st quarter	429	2,042
	2nd „	337	
	3rd „	545	
	4th „	731	
1883	1st „	794	

The figures of the last 15 months are given in quarters, to show the effect which the transfer to the Health Officer's Department, with a strengthened establishment, has had in accelerating the progress.

It will be seen from these statistics that the work of renovation is proceeding rapidly, especially during the period under report. There is still filth enough about and around bustee privies to shock a person inspecting them for the first time; nevertheless, with a few exceptions, which are daily being traced out and demolished, bustee privies in 1883 bear no resemblance to what they were before 1877. The improvement has been more than an improvement in degree, an improvement in kind.

(4.) *Structural improvement in bustees.*—The need for radical measures of reconstruction in bustees, and the steps hitherto taken for carrying out this work, will appear in the following sketch. In 1868 Dr. Tonnerre, Health Officer of Calcutta, presented a report on bustees, in which the following passages occur:—

A bustee or native village generally consists of a mass of huts constructed without any plan or arrangement, without roads, without drains, ill-ventilated, and never cleaned. Most of these villages are the abodes of misery, vice, and filth, and the nurseries of sickness and disease. In these bustees are found green and slimy stagnant ponds, full of putrid vegetable and animal matter in a state of decomposition, and whose bubbling surfaces exhale, under a tropical sun, noxious gases, poisoning the atmosphere and spreading around disease and death. These ponds supply the natives with water for domestic purposes, and are very often the receptacles of filth. The arteries which feed these tanks are the drains that ramify over the village and carry out the sewage of the huts into them. Their position is marked by a development of rank vegetation. The entrances to these bustees are many, but not easily discoverable, whilst the paths are so narrow and tortuous that it is difficult for a stranger to find his way through them. The huts are huddled together in masses and pushed to the very edge of the ponds, their projecting eaves often meeting together, whilst the intervening spaces, impervious to the rays of the sun, are converted into necessaries and used by both sexes in common. In these huts often live entire families, the members of which occupy the single appartment of which it is not unfrequently composed, and in which they cook, eat, and sleep together; the wet and spongy floor, with a mat spread on it, serving as a bed for the whole.

* * * * *

None of these villages possess a single road or thoroughfare, properly so called, through which a conservancy cart or even a wheel-barrow can pass in order to remove the filth. This filth is laid at the door of every hut, or thrown into a neighbouring cesspool.

Not a single hut in the villages is properly built. The dwellings are badly constructed, crowded together without regard to ventilation or the means of being kept clean.

This report was sent to the Engineer for opinion. Mr. Clark sent in his opinion on the 16th February 1869; it was then referred to the Conservancy Committee for consideration. The Conservancy Committee decided to wait for a further report from the Engineer. This further report never seems to have been submitted, and the matter dropped.

In his report for 1872 the Health Officer vigorously returned to the charge. He reprinted the greater part of his special report of 1868, and added—

In vain a supply of pure water has been introduced in the town, in vain our talented engineer strains every nerve to carry out his drainage scheme for the improvement of Calcutta, in vain the drainage works will be carried on, in the native portion of the town. As long as these villages are allowed to remain in their present state, we are upon a volcano, ready to burst under the slightest atmospheric perturbation, and cholera, smallpox, or any other zymotic disease, may, at any moment, make their appearance amongst us in a most virulent form, defying sanitary improvements, and thus baffling the efforts of those who have been working hard for years to prevent their return.

This remonstrance elicited for the first time the following brief notice in the official report for 1872:—

The Health Officer draws special attention to the extremely filthy condition of the native bustees, which, he states, have not undergone the slightest improvement at the hands of their owners since 1868, when he submitted a special report upon them. All efforts, adds the Health Officer, to improve the hygiene of Calcutta, will be futile until more stringent measures are taken to change these bustees from what they are now,—the depots of filth and hot-beds of disease,—to healthy villages with proper roads, drainage, and water-supply. The great difficulty is the want of money.

Nothing, however, was done either in that year or in the succeeding years to remedy the evil. At last, in 1875, the question attracted general attention. The Army Sanitary Commission in England remarked on the condition of the bustees in Calcutta, and the Bengal Government urged prompt measures on the justices. In deference to the wishes of Government a Special Committee was appointed to inspect and report on certain selected bustees. The Committee visited six of the largest bustees in the north of the town, and reported on them.

In 1876 the Municipal Act was recast, and sections 280–283 were enacted with a view to give the new Corporation sufficient powers to improve bustees. That same year the Corporation of the Commissioners entered upon its duties from the 1st October. The new Corporation set to work very vigorously with many sanitary reforms, and, as already stated, in 1877, the large Nuisance Department, which has done so much for the sanitation of the town, was organised. Tank filling was also taken in hand energetically, but the Commissioners recoiled before the difficulties of the reconstruction of bustees. A project was indeed broached for acquiring the Komedan Bagan bustee in 1877, but on the Advocate-General giving an opinion that money could not be legally borrowed for this purpose, it was abandoned, and as the Corporation soon afterwards found itself involved in financial embarrassment, no attempt was made to enforce sections 280–283 for several years. In the meantime another department was brought into contact with the bustees, which has done far more for their reclamation than has been, or for many years to come, can be done under these sections of the Act, viz., the Drainage Department, carrying out its work with drainage capital; and before resuming the history of bustee reconstruction, it is necessary to give a sketch of the benefits conferred by this Department on the bustees of Calcutta. The brick sewers, 36·77 miles in length, were only laid along the principal streets of Calcutta, and did not affect the bustees except very remotely; it was not till the pipe sewers were being laid down in the northern portion of the town, about the year 1876, that the bustees began to fall largely within the scope of the drainage works.

The system pursued was to sewer with pipes as many of the large filthy ditches as were necessary for the proper drainage of the area. These ditches were then converted into paths 3 to 12 feet wide. This was in itself a very great improvement. These paths, running in a much straighter line, and being much broader than the pre-existing tortuous paths by which alone the bustees were traversable, were in some cases practicable for carts, in all cases for wheel-barrows, and became outlets by which the refuse and filth of the houses and above all of the goala-baris, could be conveyed away. In many places, however, the improvements went further. Where large areas of land, as in Mitter's Lane bustees or in Singhee Bagan, were covered with bustees without a single public road for many hundred yards, enough of land was acquired when laying down the sewers to construct a broad thoroughfare 15 to 20 feet wide. In these cases the bustee has been improved beyond recognition, and has undergone complete transformation. To such areas the description given by Dr. Tonnerre or the Committee of 1875 has altogether ceased to apply, and the reform has been radical.

Combining all the results we have, as the bustee area sewered, and pierced by roads and paths since 1876—

—	Roads.	Ditches converted into Paths.	Total.
1876–79 - - -	1,465,000	8,217,000	9,682,000
1880–83 - - -	3,504,000	11,467,000	14,971,000
Total - -	4,969,000	19,684,000	24,653,000

14,400 s. feet equal a standard bigah, hence the total bustee area sewered and pierced with roads or paths since 1876 amounts approximately to 1,714 bighas. As there are only 3,074 bigahs of bustee in the whole town, many of which are very small and capable of surface drainage, it will easily be understood what an enormous revolution in the condition of the bustees has been silently effected by the operations of the Drainage Department. Many bustees have been so thoroughly reclaimed as to be quite unrecognisable by those who knew them in their former condition. It will be seen that here, as under all other heads, the rate of progress has been accelerating, so that much more has been done in the last 3½ than in the preceding four years, and as a fact much more in the last than in any preceding year.

The above is an outline of the work done by the Drainage Department, the main objection to which is, that necessarily everything is done for the owners, and nothing by them, except in certain well-known cases in which the owners have made gifts of the whole or a part of the land. Their property gets the benefit of the improvement, and the Municipality pays for it. There is, however, one important exception to this, viz., the drainage connections of private premises. As soon as a bustee is sewered, the owners can be, and as a rule, are called upon under section 222 to connect their premises with the sewers at their own cost, and if they fail to comply, the work is done by the Corporation and the amount recovered. To this extent owners have to pay for their own improvements. It is believed to be a fact admitting of no question, that where these improvements have been carried out, the value of property has risen considerably.

It remains to show the work done under the provisions of sections 280 to 283. At the end of 1877 the Commissioners found themselves with a large deficit, which was scarcely reduced at all during 1878. The finances fell into a condition of the utmost confusion, owing to the shortcomings of the Collector's Department, and the Corporation was on the brink of insolvency. The year 1879 was devoted to altering the system of collections, and to rescuing the finances from their chaotic condition, and no attempt was made to deal with bustees under the Act. At last, in 1880, a beginning was made so far as to allot in the budget a sum of Rs. 20,000 for bustee improvements, *i.e.*, for assisting the owners in carrying out any improvements which might be determined upon by the Commissioners. No such improvements were, however, ordered, and of this amount, only Rs. 509 were expended, chiefly in preparing the projects for two large blocks, called the Sortee Bagan and the Patwar Bagan blocks, and in obtaining their medical inspection. This only took place on the 2nd December 1880, and the Engineer was then directed to submit detailed schemes for their improvement.

Nearly the first half of 1881 passed before these schemes were ready for submission, so that it was only in May 1881 that the Bustee Committee was able to set to work at and discuss the projects. The Soortee Bagan scheme was first taken up, and it was over its discussion that the Commissioners acquired the experience which has enabled them to dispose of subsequent projects more expeditiously. Rules of procedure designed to give the owners a fair opportunity of being heard were drawn up as set forth in paragraph 71 of the Report for 1881. The area of Soortee Bagan is about 64 bigahs, and the Engineer's project suggested an expenditure of Rs. 51,443 by the owners.

1,49,242 „ Municipality.

2,00,685

This was manifestly too expensive, considering the sums that could be allotted from revenue for the improvement of bustees, and the scheme, as finally settled by the Commissioners, contemplated an expenditure of Rs. 30,667 by the owners.

28,193 „ Municipality.

58,860

This was finally passed by the Commissioners in Meeting on the 26th October 1881, and it was the only project passed within that year. A sum of Rs. 30,000 had been set apart in the budget for bustee improvement, but only Rs. 5,377 could be expended within the year.

Many other projects have been subsequently taken up, and are now in various stages of progression.

Expenditure on bustee improvements under sections 280-283.—The grant made for bustee improvements in 1882 was Rs. 30,000, to which one-fourth, Rs. 7,500, was added

for the first three months of 1883, raising the total grant for the 15 months to Rs. 37,500. The expenditure to the end of December was Rs. 22,416, but in the first quarter of 1883 it was very heavy and amounted to Rs. 17,656. The total expenditure was thus Rs. 40,069, or Rs. 2,560 in excess of the grant.

The following figures speak for themselves as to the attention which bustees have received during the last two years :—

	Budget grant.	Expenditure.
1879 - - - -	—	—
1880 - - -	10,000	509
1881 - - -	30,000	5,337
15 months 1882–83 - -	37,500	40,069

The Commissioners have set apart funds for the current year commensurate with the completion of the projects which are in hand. The sum of Rs. 1,50,000 has been allotted in budget for bustee improvements at the instance of the Bustee Committee.

Tank filling.

(5.) *Obliteration of foul tanks.*—The operation of tank filling is the only town improvement which does not show an unquestionable acceleration in the rate of progress during the period under review. Still the rate of progress has increased somewhat, and as rapidly as could be reasonably expected. The filling up of the ponds and hollows in bustees was one of the measures of improvement advocated by Dr. Tonnerre as far back as 1868. Nevertheless, it was only with the accession of Dr. Payne to the post of Health Officer that the urgency of the work was insisted on. A great portion of his well-known report for 1876 (a report which ought to be read carefully by all who are interested in the sanitary improvement of Calcutta) is devoted to tracing out the evil effects of filthy tank-water on the health of Calcutta.

As a consequence of the views of the Health Officer, tank filling commenced in 1876, and its progress in subsequent years is shown thus :—

	Tanks filled.
1876 - -	10 completed.
1877 - -	38 ,,
1878 - -	20 ,,
1879 - -	8 ,,
1880 - -	15 ,,
1881 - -	14 ,,
15 months 1882–83 - -	33 ,,

Eight tanks commenced to be filled up in 1882–83 were finished after the 31st March, and will fall in the current year's record. It will be seen that in the case of tank filling, as of all other improvements, 1879 was the year of weakest effort; this was partly due to attention being concentrated on the work of financial reform, partly to the difficulty experienced in filling up tanks not within private enclosures, the cost of which could not be recovered. In the amending Act of 1881 a section was introduced authorising the Commissioners to recover the cost of filling up tanks as well without as within a private enclosure, the good effect of which is visible in the increased work done in 1882–83. In other respects the work of tank filling has become more difficult, owing to the prosecution instituted in 1881 against the Corporation for filling a tank. The magistrate's decision was tantamount to a declaration that to fill a tank with refuse is an unlawful nuisance, and hence the subsequent operations of Corporation are carried on as it were under sufference, and increased expenditure has to be incurred for a more liberal mixture of earth with the refuse. The total cost of tank filling in 1882–83 was Rs. 7,923 against Rs. 5,186, the cost in the 12 months of 1881, but of this amount Rs. 6,155 were recovered, the net loss being therefore only Rs. 1,768. It should be stated, however, that in 13 out of the 33 tanks the work was carried out by the owners, which is a very encouraging sign.

Although the number of tanks of all sorts in the town is still very large, the majority of the worst class of tanks has been filled up.

Conservancy.

(6.) *Establishment for cleansing bustees.*—The necessity of a conservancy establishment for the surface cleansing of bustees was urged as far back as 1876, and in 1877 it was actually entertained for a short time.

When the new Bustee Committee asked in the end of December for a comprehensive scheme of improvement, the necessity of entertaining an establishment such as Dr. Payne had entertained in 1877 was especially noticed. The result was that the Budge Com-

mittee sanctioned the entertainment of a staff of two inspectors, 7 peons, and 200 dhangurs with 32 carts, for the surface cleaning of the bustees, and this establishment has been entertained with the best results from the commencement of 1883–84.

(7.) *Measures for improving cow-shed—Rules passed in 1879.*—What the ordinary old-fashioned bustee is to a well-kept compound, that a bustee crowded with cow-sheds is to an ordinary bustee. The cows are huddled together in a shed not large enough for half their number. The whole neighbourhood of this shed gets saturated with liquid manure, which oozes into the nearest tank, if tank there be, if not, into the nearest hollow, where it stagnates. Where 8 or 10 of these are in close proximity, the conglomeration of filth may be easily conceived. Nothing practical was ever done to abate this nuisance till 1879, when the Commissioners took up the matter, and framed the following conditions for the grant of licenses under Section 247 :—

"Every house used for the purpose of a cow-shed shall in future be raised at least 3 feet above the level of the ground, and shall allow of a space 5 feet in width and 7 feet in length for each cow stabled. The stable shall be paved with cut stones, which can be supplied by the municipality, unless the stable be boarded or tiled. Each stable shall have a slope towards one side, and shall be divided by an open drain running into a cesspool 4 feet square, formed of masonry, plastered and cemented, outside the stable.

"No cow-shed shall be licensed if situated in a locality unapproachable by the municipal conservancy carts.

"All milkmen shall be required to take out trade-refuse licenses, the municipality undertaking to remove daily their stable refuse."

These rules, if enforced, were well adapted to their object; but the difficulty was, that rule 2 threatened with extinction a large number of cow-sheds, while rule 1 required an initial outlay quite beyond the means of the cow-keeper.

The owner does nothing but lease out his land—all erections, all expenditure, and all risk are, as usual, left to the tenant. The law puts no responsibility on the owner, and custom, and (of necessity) the rules framed by the Commissioners, follow the law. But to try and make an ordinary *goala* incur such expenditure as rule 1 contemplates was almost an impossibility. The result was, that throughout 1879 and 1880 the rules remained a dead letter. Licenses were refused in 1880 because the conditions were not complied with; but the result was that all the cow-sheds remained with impunity unlicensed. For the first half-year of 1881 only two in the whole town took out licenses, a result which was worse than their being licensed without fulfilling the conditions, as thereby the Commissioners lost all touch of them. The course adopted in 1881 was to prosecute wholesale for neglect to take out licenses, but to accept promises to comply with the conditions gradually from such as applied for licenses, the Commissioners having given the Chairman authority to dispense with any of the three conditions which could not practically be complied with. 566 prosecutions were therefore instituted in 1881, with the result that 373 *goalas* took out licenses in the second half-year on various conditions.

In 1882 an officer was specially told off to supervise this work. The number of *goalas* in the town is reckoned as 564. Of these 425 now hold licenses on such promises of performances as have been deemed satisfactory; to the remainder licenses have been refused, and 664 prosecutions have been instituted; but the fines imposed are small compared with the cost of the improvements, and it takes repeated prosecutions to enforce compliance. Of the 425 licensed *goalas*, 135 did not satisfy rule 2, and 226 did not satisfy rule 3, at the end of March last. The former being old-established places which had done their best to clean up, were tolerated, while the 226 who did not take out trade-refuse licenses included the above 135, as well as 91 more excused for some special reason. Even as regards rule 1 some progress has been made. 13 *goalas* had reconstructed the *barees* in accordance with the rule by the end of March, and 14 others were in process of doing so, while a large number more had promised to do so with the knowledge that licenses would be refused, and prosecutions infallibly pressed, if they did not. A breach has fairly been made in the passive resistance of the *goalas*. Already there is considerable amelioration, while the labours of bustee cleaning staff have also helped, and it may be hoped that by the end of the current year the improvement will be beyond question.

Moreover, as a stimulus in this direction, the Commissioners have sanctioned an outlay of Rs. 5,000 to build a model cow-shed, and lease it out to *goalas*. Should it so far answer that the rent gives a fair outlay in the expenditure, more will follow; but in any case it will serve as standard to show what the cow-keepers have to aim at.

(8.) *Structural improvements in the streets of the town.*—These improvements have to be divided into three heads: (1), the improvements effected from capital; (2), the improvements effected from the regular Town Improvement (revenue) Fund; and (3), improvements effected from other revenue funds.

(1.) *From Capital.*—In the course of the year a portion of the out-offices of the town hall were acquired by Government, the purchase-money of which amounted to Rs. 31,280. As about that time there was a large fire at the end of Nimtollah Street, which had always been particularly narrow and obstructed, it was thought that the opportunity ought not to be lost of widening the orifice where it enters Strand Road to 50 feet before the houses were rebuilt, and similarly of widening the junction of Durmahatta and Strand Road, which was only a few yards distant. It was agreed, therefore, to devote this purchase-money to that object. The work was carried out very successfully, the entire cost within the year was only Rs. 19,858, though the Deputy Collector has had to pay a further sum of about Rs. 4,000 after the close of the year. Still, considering the importance of the improvement, the cost was very little, owing to only land having to be acquired. The result is that two important thoroughfares, which formerly tapered at their orifices, causing almost incessant blocks among the gorged cart traffic, have now fine wide entrances, in which blocks no longer occur. Few improvements that have been carried out in the town have been more satisfactory.

A large quantity of surplus land, lying useless in the hands of the Corporation, was sold during the year, and realised more than a lac of rupees. As the Chitpore Road improvement was at a standstill, owing to the more modest scheme for improving 230 yards of the narrowest part of the road being estimated to cost Rs. 50,000 more than the fund would afford (Rs. 1,20,000), the Commissioners voted this amount from the proceeds referred to above. So that the widening of the Chitpore Road is, in fact, being partly carried out from capital. This work is an improvement of the utmost importance to the welfare of the town, but the cost is so heavy, that the Commissioners do not at present see their way to complete it.

(2.) *From ordinary town improvement fund (revenue).*—In 1879 the Commissioners for the first time voted a sum of Rs. 10,000 in the budget of 1880, to be devoted to town improvements, but out of this only Rs. 1,207 were spent. In 1881 the grant was fixed at the same amount, and Rs. 10,104, or a little in excess of the grant, spent. As a number of very important and costly improvements had been sanctioned in 1881 which remained to be carried out from the grant of 1882, the Commissioners raised the grant to Rs. 30,000. To this Rs. 15,000 were added for the extra quarter which the new Act included in the municipal year, making a sanctioned total of Rs. 45,000. The expenditure has, however, exceeded even this figure, and aggregated Rs. 46,241. It will therefore be seen that under this grant, also, much more has been effected than in any preceding year.

(3.) *Improvements from other revenue funds.*—The widening of the Chitpore Road, which is being carried out partly from capital resulting from the sale of waste lands, partly from a contribution from the late fire brigade fund, partly from a contribution from the general fund, has been already referred to under "Improvements from capital." Besides this the surplus of the hackney carriage fund, amounting to Rs. 18,260, was devoted to taking up land for four new stands in the most crowded thoroughfares, and paving the standing ground of two of them with stone bricks, and making proper surface drains, so as to minimise the nuisance which a stand always causes. In this work the whole fund was exhausted, and a supplementary grant had to be made from the general fund of Rs. 2,721.

Taking all these heads together, the Commissioners may fairly claim to have effected many and valuable improvements in the streets of the town. Unquestionably far more has been done during the period under review than in any previous year since the Corporation of the Commissioners has been constituted.

Concluding remarks on this part of the Report.—Reviewing this part of the Report as a whole, the Commissioners cannot but feel that they are justified in claiming that the improvement of the town, both sanitary and structural, has received no ordinary share of their attention. Every head shows an accelerated rate of improvement, and a *bonâ fide* earnest effort to grapple with the evil that has to be overcome. Such classes of improvements as were already in full working show more rapid progress than before, while under heads 6 and 7 arrangements have been organised for the first time (except Dr. Payne's unsanctioned efforts in 1877) which promise the happiest results.

The work which has been done by the Commissioners, as set forth in the above narrative, has been carried out quietly, unobtrusively, unostentatiously, and out of the sight and knowledge of the ordinary purveyors of information to the Calcutta public. It has no *vates sacer*. But the Commissioners feel confident that no candid person is likely to peruse this account without coming to the conclusion that, as has often happened before, the popular uninformed opinion is almost the direct opposite to the true fact. The Commissioners are well aware that very much remains to be done, but where they can show so much as having been done, they may fairly claim the public confidence, that the residue will not be neglected, and that they are fully equal to coping with the task before them.

It is not too sanguine to express a hope that, at the present rate of progress, the northern portion of the town will be, if not in a perfect sanitary condition, at least in a very tolerable sanitary condition, within one year after the water supply is doubled. Almost every reform depends for its completion on an augmented supply of water.

ABSTRACT OF REPORT OF THE HEALTH OFFICER FOR CALCUTTA FOR 1882-83.

(Dr. K. McLeod.)

In accordance with the provisions of Act I (B. C.) of 1882, annual reports will for the future be prepared for the official year (ending 31st March) in place of the calendar year, as heretofore. It is therefore necessary that this report should embrace a period of 15 months (commencing 1st January 1882, and ending 31st March 1883). In order to maintain continuity of record, and facilitate comparison with the past, the report will mainly concern the calendar year 1882, and all comparisons with preceding years will refer to corresponding periods. The statistics of the three months January, February, and March 1883, will be inserted as a supplement, and the narrative of the sanitary state of Calcutta brought up to 31st March 1883. Future reports will embrace the official year, and the statistics of previous years will be recast, so as to obviate the hiatus which would result from a comparison of calendar and official years.

There is nothing worthy of note in the meteorology of the year. It may be pronounced normal. The temperature of the year was, on the whole, a little higher than usual. The humidity of the year was also high: that of October and November being conspicuously so.

The rainfall of the year fell short by but two-tenths of an inch of the mean fall of the preceding 48 years. The distribution of the fall departed in some respects from the fall of former years, February and October receiving an undue share of the total, and June, July, and August less than the wonted amount.

Since the close of the year the weather has been characterised by an unusually low temperature in January and February, and a heavier than usual fall of rain in February; this took place on the 25th and 26th of the month. Rain also fell in smaller quantities almost daily from 5th to 11th March, and was accompanied by considerable atmospheric disturbance. The humidity of March was rather high. In other respects the meteorology of the first quarter of 1883 was normal.

The cost of food has been moderate throughout the year, and prices have continued moderate up to the close of the first quarter of 1883.

Vital statistics.

The number of births registered during the year was slightly in excess of 1881, and 1,098 over the mean of the preceding decennium. The rate, 17·3, is exceeded by only one year of that series, namely 1880. The improvement in birth registration, which commenced in 1875, has been sustained, but, for the reasons stated fully in last year's report, there can be little or no doubt that a considerable number of births in Calcutta still escape registration. The statistics of 1882 agree with those of previous years in showing an excess of births in the last quarter of the year.

Statement of Births registered from 1872 to 1882.

Years.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	Ratio per 1,000 of population Census 1881.
1872	340	343	455	345	340	305	333	390	396	397	393	326	4,364	10·5
1873	294	238	354	378	354	300	369	456	419	437	500	499	4,593	10·6
1874	452	334	348	317	369	343	394	406	392	430	420	456	4,863	10·7
1875	415	334	393	778	606	570	569	633	650	720	727	606	7,001	16·1
1876	498	500	576	541	509	566	694	665	710	705	789	719	7,452	17·2
1877	570	552	588	796	427	491	647	648	709	708	661	755	7,457	17·2
1878	638	530	611	550	526	489	496	607	573	653	640	612	6,925	15·9
1879	482	464	450	426	458	430	410	497	404	668	723	795	6,409	14·7
1880	549	501	591	556	580	580	620	583	568	766	774	784	7,552	17·4
1881	561	620	599	595	492	548	584	568	605	706	750	730	7,458	17·2
Mean of 10 years	509	441	496	518	466	462	511	545	572	618	635	628	6,107	14·7
1882	609	584	664	555	566	504	518	556	658	789	764	683	7,505	12·3
1883	642	592	618	—	—	—	—	—	—	—	—	—	—	17

The returns of the first quarter of 1883 present results corresponding closely with recent years.

The death-rate of the year must be pronounced excessive. Only three years in the preceding decade present higher aggregates, and the rate is also in excess of the decennial mean. Cholera is the main cause of increase; "other causes," though rendering fewer deaths than in 1881, present a striking contrast with the average. Under other heads, as shown in the following table, the results of the year are satisfactory, more particularly as regards smallpox. The mortality of the first quarter of 1883 has also been somewhat in excess of the preceding decennium, the excess being due to an increase of deaths from cholera, bowel-complaints, and other causes.

Statement of Deaths from the most prevalent diseases from 1872 *to* 1882.

Years.	Cholera.	Diarrhœa and Dysentery.	Fevers.	Smallpox.	Other Causes.	Total.	Ratio per 1,000 of population, Census 1881.
1872	1,102	1,365	4,895	18	2,972	10,352	23·8
1873	1,105	1,351	4,632	33	3,235	10,356	23·8
1874	1,245	1,358	4,461	120	4,343	11,527	26·6
1875	1,674	1,579	5,328	720	4,785	14,086	32·5
1876	1,851	1,864	4,361	71	4,817	12,964	29·9
1877	1,418	1,683	5,151	67	5,385	13,704	31·6
1878	1,338	2,010	6,086	1,495	5,467	16,396	37·8
1879	1,186	1,516	4,796	772	4,774	13,044	30·1
1880	805	1,267	3,797	114	5,698	11,681	26·9
1881	1,693	1,491	3,765	133	5,948	13,030	30
Mean number	1,341	1,548	4,727	354	4,742	12,714	29·3
1882	2,240	1,454	3,618	17	5,848	13,177	30·4
1883, first quarter	560	487	927	38	1,422	3,434	31·7
1873–82, first quarter	440	430	1,107	145	1,206	3,330	30·8

The varying death-rates of different sections of the town have been illustrated and commented upon in previous reports. The feature is also evident in the figures of 1882; but, as compared with the preceding decennium, there is a greater tendency to equalisation than usual, the habitually low showing higher rates, and the habitually high somewhat lower. The higher death-rates correspond generally with the more extensive *bustee* area, thus affording statistical evidence of the great insalubrity of *bustees*, and the extent to which their presence in a ward comprises its health.

The death-rate of the suburbs, though still greatly in advance of that of the town, presents an improvement as contrasted with the last few years, as is shown in the following statement:—

Year.	Town.		Suburbs.	
	Actual Number of Deaths.	Per 1,000 of Population.	Actual Number of Deaths.	Per 1,000 of Population.
1877	13,704	31·6	14,025	55·7
1878	16,396	37·8	17,459	69·4
1879	13,044	30·1	13,835	55
1880	11,681	26·9	11,216	44·6
1881	13,030	30	11,143	44·3
Mean	13,571	31·3	13,535	53·8
1882	13,177	30·4	10,470	41·6

The abatement in the suburban mortality, as compared with that of the previous year, is due to a decline of deaths from fevers, bowel-complaints, and "other causes," smallpox showing a slight rise, and cholera a considerable advance. The following table presents the figures of the year in monthly detail:—

Suburban Deaths in 1882.

Months.	Cholera.		Smallpox.		Fevers.		Bowel Complaints.		Other Causes.		Total.	
	1882.	1883.	1882.	1883.	1882.	1883.	1882.	1883.	1882.	1883.	1882.	1883.
January	145	291	—	2	434	457	154	208	233	258	966	1,216
February	150	228	3	14	322	338	101	140	227	204	803	924
March	223	345	7	17	345	314	77	133	180	175	832	984
April	231	—	6	—	312	—	68	—	188	—	805	—
May	334	—	4	—	305	—	67	—	127	—	805	—
June	187	—	1	—	258	—	58	—	167	—	671	—
July	51	—	1	—	268	—	84	—	210	—	614	—
August	46	—	—	—	329	—	106	—	238	—	709	—
September	74	—	—	—	334	—	118	—	214	—	740	—
October	172	—	—	—	364	—	124	—	270	—	930	—
November	210	—	1	—	439	—	115	—	253	—	1,011	—
December	529	—	—	—	494	—	188	—	263	—	1,474	—
Total	2,549	864	23	33	4,203	1,109	1,260	481	2,635	637	10,470	3,124
Ratio per 1,000 of population	9·3	13·7	·9	·52	16·7	17·6	5·1	7·6	10·4	10·1	41·6	49·6

Cholera.

The past year has been an exceedingly unfavourable one in respect of cholera. In no year since 1869 has there been so large an aggregate mortality from this cause. The nearest approach to it is 1876, in which 1,851 deaths were registered. The mean of the 12 years 1870 to 1881 was 1,314. But although the cholera aggregate of 1882 was unprecedented in recent years, it only amounts to about a half of what seems in former times to have been the habitual mortality from cholera in Calcutta. Dr. Macpherson, in his work on cholera in its home, gives the aggregate statistics of cholera for 26 years, ending 1860. The mean of the series is 4,011 annual deaths. The mean of the five years, 1865-69, is 4,388. Taking 4,000 to represent the annual cholera mortality of Calcutta prior to 1870, a saving of 34,000 lives may be fairly credited to sanitary improvements, more particularly to the supply of pure water for drinking and cooking purposes to the town. The cholera mortality of the suburbs presents a rise of 25 per cent., against 33 per cent. for the town.

In all cases in which the disease presented any tendency to grouping, special investigation was made, and every instance in which several cases had occurred in a house or village, or within circumscribed limits, glaring insanitary defects were discovered. A foul tank, obstructed drainage, fœtid ditches and cesspools, ill-kept byres, offensive latrines, and so forth. Numerous cases might be detailed in support of this statement, but the conclusion forced upon me by all that I have seen of cholera since I became Health Officer of Calcutta, is that the disease flourishes in places and among communities where cleanliness is neglected, and filth of kinds allowed to lodge and fester in various ways and under various circumstances. The results of my inspections have in each instance been communicated to the Chairman, and recommendations made according to the nature of the sanitary defects discovered. These recommendations have invariably received prompt attention.

Bowel-complaints.

Although cholera was in excess in 1882, deaths from dysentery and diarrhœa were below the average. Fatal fluxes, however, occur under such a variety of conditions, and in association with so many diseased conditions of the body, that any discussion of totals represented by the term "bowel-complaints" would be absolutely valueless. These diseases are less fatal in the rains, and more fatal in the cold weather months.

Fevers.

The year has been a very favourable one as regards fatal fevers. In no year of the preceding decade have so few deaths been registered under this head. Special care has been taken to check the accuracy of the entry of enteric fever, with the result that the number of deaths returned under this head has fallen from 569 in 1882 to 175 in 1883. It is more than doubtful whether this figure is correct. Only six cases were registered among Asiatics, and four among mixed races. In the month of November I addressed a circular to the principal medical practitioners of the town, requesting them to intimate to this office the fact of any case of enteric fever occurring in their practice, with a view to investigating the circumstances under which the disease was contracted. Up to the close of March only two reports were received. The result of inquiry was to reveal a neglected latrine in one case, and faulty drains in another. It is quite certain that

enteric fever is a rare disease in Calcutta. Cases are occasionally met with, but they are rare—much rarer than in the large cities of Europe and America. Inquiries instituted in the hospitals during the year support the statements recorded in my report for 1881, that the disease is very seldom met with in the large hospitals of Calcutta.

Smallpox.

Only 17 deaths were registered under smallpox in 1882—a smaller total than in any year of the preceding decade. A minimum of prevalence has now been reached, following the severe epidemic of 1878–79. Calcutta has been visited periodically by epidemics of smallpox from time beyond record. In 1832–33 an epidemic raged, which caused 3,227 deaths; in 1837–38 another, which killed 1,773 persons; in 1843–44 another, from which 3,176 died; in 1848–49–50 another, which caused a mortality of 6,261; one in 1856–57–58, killing 3,478; one in 1863–64–65, slaying 5,656; a slight outbreak in 1870 with 151 deaths; another in 1874–75 with 900; and a severe epidemic in 1878–79, from which 2,267 died. The years intervening between these outbreaks show less than 100 deaths, but none of them is blank. Since the close of the year apprehensions have been entertained of a fresh epidemic movement in Calcutta.

Vaccination.

The number of vaccinations performed during 1882 was 7,802, against 6,538 in 1881. Of these, 7,273 were primary vaccinations, and 529 re-vaccinations, against 5,523 and 1,015 in the preceding year. These figures indicate a marked improvement, due to greater diligence on the part of the staff, and also to the aid derived from the returns of unvaccinated children obtained from the registrars under section 23 of Act V. of 1880 (B.C.). Substantial progress has been made in carrying out the provisions of the law, but difficulties are still encountered, and many children escape vaccination owing to the long period allowed by the Act. The increased number of vaccinations performed in 1882 during the hot weather and rains is specially noteworthy. I have inspected the vesicle weekly, and invariably found it satisfactory.

Since the close of the year, under pressure of an impending epidemic of small-pox, vaccination has been pushed with greater activity, as the following extract from the report for the first quarter shows:—"Six thousand and sixty-three persons were vaccinated, and 2,246 re-vaccinated, during the quarter, against 4,263 and 475 in the first quarter of 1882. This great augmentation has been due to the greater anxiety of the public, and more active exertions of the department, in view of the probability of an epidemic outbreak of smallpox. Animal vaccination has now been established in Calcutta, and though the vesicle does not seem to be quite so strong as that already in use, the public possess, through the liberality of Government, the option of obtaining vaccine from the calf, which many persons prefer."

Progress in sanitary work.

Measures having for their object the improvement of the sanitary state of the town have been pushed on with vigour. New roads have been made, foul drains have been piped and converted into clean pathways, new areas have been provided with sewers, and the houses connected with these for the removal of house and bath washings which previously stagnated and stank. Streets have been widened and facilities provided for the removal of refuse; tanks, and wells containing water which has truly been described as diluted sewage, have been filled up, and substantial progress made in the reclamation of some of the worst bustees of the town.

But although great sanitary improvements have been accomplished in Calcutta, and year by year palpable progress is being made in the direction of reform, there still remains much to be done ere the sanitary condition of the town can be pronounced in any sense satisfactory. This undoubted fact has found loud expression in the shape of a public agitation which took place at the commencement of the cold weather of 1881–82, and was repeated with renewed vigour at the beginning of the cold season of 1882–83. On each occasion the municipality has responded by appointing a carefully selected committee for the purpose of inquiry and deliberation. The outcome of these proceedings has been—

1st. The organisation of a nuisance department.

2nd. The organisation of an establishment for bustee conservancy.

3rd. The assignation of more money for bustee improvement and general conservancy.

4th. Change of method in dealing with rubbish in certain parts of the town. The material, in place of being cast on the footpaths and roadways, is now retained in bins and baskets, and removed from the interior of compounds by carts.

5th. Accelerated effort to increase the water-supply of the town.

6th. Careful study of the sewer system, and consideration of measures necessary for its improvement.

The tabular statements appended to the Municipal Report, containing the results of periodical and systematic analyses by Mr. A. Pedler, show that the water supplied to the town continues to be of excellent quality. The question of increasing the supply—a measure which is urgently desirable—has been under earnest discussion during the year. Three alternative proposals engaged the attention of the Commissioners—namely (1) conveyance by an open cut with subsequent filtration; (2) conveyance after filtration by a brick conduit; and (3) conveyance after filtration by an iron main, as at present. It has been decided, I rejoice to write, to adopt the last of these measures, and it may be expected that at no distant date the supply of water of similar purity to the present will be doubled.

ABSTRACT OF REPORT OF THE MADRAS MUNICIPALITY FOR 1882.

(Mr. A. T. Arundel.)

Drainage.

The drainage scheme for Black Town was actively commenced during the year under report. The large well at Rayapuram, where all the sewers are to converge, and whence the sewage is to be lifted by steam-pumps, was the first work to be undertaken. Very great difficulty was experienced in carrying out this work, owing to the extraordinary abundance of the springs of fresh water met with at no great depth below the surface. The steam-pump was kept in action night and day, and with the aid of the electric light for night work the foundations of the well and of the connecting sewer were at last successfully got in. Considerable progress was made with the building of the engine and pump house. The engines, boilers, and Gwynne's centrifugal pumps for lifting the sewage, were received from England, and the boilers and pumps were put in position in the engine house. The sewage discharge pipe—a cast-iron pipe 24 inches in diameter, 4,600 feet in length—to carry the sewage from the well to the outfall channel north of the town, was successfully laid in position.

The outfall channel begins where the discharge pipe ends, and is intended to lead the sewage to an outfall into the sea at a spot more than two miles north of the pumping station. This channel is 7,664 feet long.

The useful work of diverting sewers from the Cooum and canal was not neglected during the year. Arrangements were made for diverting three large sewers from the Cooum to a pumping-station in the Napier Park. The necessary intercepting sewers were laid, and the well and engine-house nearly completed. A large sewer that discharged its offensive contents into an arm of the canal in the Salt Cotaurs was diverted to form a sewage farm at Teroopulley Street.

A valuable sanitary improvement was effected in the reconstruction of the outfall of the Choolay main drain, about 2,255 feet in length. This drain discharges its contents at the De Mellow's Road Sewage Farm, where the sewage is used for irrigation. Prior to its reconstruction the water-way was insufficient, and the sewage used at times to escape to and stagnate in a shallow tank (Kariankoottay) west of the People's Park, which was a nuisance to the neighbourhood.

The extension of the south main drain to the sea was nearly completed during the year.

Water-supply.

For the extension of the water-supply throughout other parts of the city, a loan of Rs. 2,50,000 was contracted. The pipes and other materials began to arrive in May, and by the end of the year the work of pipe-laying, &c., was completed in the 5th, 6th, and 7th Divisions. In these divisions over 17 miles of pipes were laid, varying from one to six inches in diameter, 124 valves and 211 hydrants were fixed, and 133 fountains were erected. The extension of the water-supply is a boon fully appreciated by the inhabitants. A fountain has been erected opposite the General Hospital in the vacant ground that has now been turned into a pleasant garden or park for the use of the public.

The water-supply from the Red Hills Lake was maintained throughout the year, but the scanty rainfall in the first half of the year brought down the level of the lake lower than it had been since the famine of 1877, and, but for a timely fall of rain in November, it would have been necessary to send out steam-pumps to lift the water from the lake into the delivery channel. The scour pipes attached to the principal water mains are of great service in removing sedimentary deposits from the pipes, but until a regular system of filtering has been adopted it will be impossible to keep the water free from accumulations of fish, snakes, and vegetable growth. Fish ten inches long have been found jammed up in two-inch pipes, and these must, at the entrance of the main, have passed as ova through the wire gauze meshes 256 to the square inch in addition to a charcoal strainer a foot thick. The delivery channel was kept in good order throughout the year, the quantity of water drawn off during the year from the Red Hills Lake into the municipality delivery channel was 4,849,407 cubic yards, payable to Government for the water at the rate of Re. 1 per 1,000 cubic yards.

In the removal of rubbish and filth 1,219 coolies, 621 carts, and 5 canal barges were employed. There were removed 404,000 cart loads, besides about 16,530 tons of night-soil. The conservancy system is far from complete, and will require careful improvement as soon as additional funds are provided under the revised Municipal Act. The cost of hire of bullocks was Rs. 1,04,680 against Rs. 99,440 in the budget, in which provision had been made for only 11 months' charges. The expenditure for the cleaning of the main drains was only Rs. 987-2-3, against an estimate of Rs. 9,120. This was due to the fact that the bills for work done were not received in time for check and payment during the year. Conservancy.

The Nagatha Covil Parcherry, near Rayapuram, was cleared away, and new lines of dwellings of improved character and sanitation are being erected instead. An unhealthy Parcherry in the Mount Road was also removed.

The figures of the census of 1871 are used in this report. The census returns of 1881 were received in May, but as the figures are given for the wards of the city only, and not for the different villages of which the city is composed, it will be necessary to change the method of record and report in future. Health of Madras.

The birth-rate per 1,000 was 42·7, as compared with 40·3 in 1881, 40·4 in 1880, and 41·8 in 1879. The total number of births was 16,991 as compared with 16,025. The percentage of male births to female was 52·1 to 47·9. 966 more births were registered than in 1881. The registration of births thus shows considerable improvement. I do not, however, regard it as complete as the registration of deaths.

The death-rate was 35·6 against 38·9 in 1881 and 37·4 in 1880. The total number of deaths was 14,169 against 15,487 in 1881. The average of the previous 10 years was 14,946. The number of deaths among males was very slightly in excess of the number among females, there being 7,108 of the former to 7,061 of the latter. There were 1,318 deaths less in 1882 than in 1881. This is mainly due to the non-prevalence of smallpox of a severe type. The deaths were:—

	1881.	1882.	Increase.	Decrease.
Smallpox	1,654	355	—	1,299
Measles	299	148	—	151
Fevers	8,698	8,706	8	—
Cholera	126	461	335	—
Bowel-complaints	1,925	2,110	185	—
Other diseases	7,785	7,389	—	396
	15,487	14,169	528	1,846

LIBRARY OF THE ROYAL BOMBAY BRANCH OF THE ASIATIC SOCIETY.

The first cholera case occurred in September 1881, there were 2 cases in October, 40 in November, 83 in December, 160 in January 1883, and 203 in February, when the epidemic reached its climax. The cases fell to 74 in March, to 20 in April, and to 4 in May, after which no further case occurred. The first point to be noted is that the disease was not apparently influenced by weather. It made its appearance with 1 case in September, when 6 inches of rain fell, there were only 2 cases in October, when 1 inch of rain fell, while there were 40 in November, when 12 inches of rain fell. In January there was no rain after the 3rd of the month, but there were 160 cases, there was no rain in February, but there were 203 cases, and no rain in the next three months, during which the disease entirely died out. The next and a most important point to notice is, that the disease fell most heavily on those parts of the town that were dependent on wells for their water-supply, and were beyond the distribution of the Red Hills water pipes; 333 deaths or 57 per cent. occurred in these localities, namely, Rayapuram and to the north of it, and St. Thomé, with a population of 86,000, or one-fifth of the whole of Madras, while 254 deaths occurred in the rest of the city, with a population of 320,000. The extension of the Red Hills water-supply during 1882 will, it is hoped, when combined with careful sanitation, confer still greater immunity from disease on the greater part of the city. The localities to the north of Rayapuram cannot be supplied with water under the present system. In the month of February, in compliance with my suggestion, the Government appointed Dr. King as Special Sanitary Officer, under section 41 of the Municipal Act, to advise as to any special measures that might be found necessary in sanitation and conservancy. A special conservancy staff was placed at Dr. King's disposal. Cholera.

Vaccination.

The total number of cases vaccinated was 28,030 against 30,908 in 1881, showing a decrease of 2,878 cases. The increase in 1881 was abnormal, and was due to an unusually severe outbreak of smallpox, which induced the people to resort to vaccination. The vaccination staff, however, owing mainly to a change in the Deputy Inspector, did not work so efficiently as in the previous year. The successful cases were 25,143, the unsuccessful 1,673, while 1,214 were unknown. The number under one year vaccinated in 1882 was 8,968 against 8,798 in 1881. This shows an increase of 170 in the vaccination of infants, and is so far satisfactory. There were 16,991 births in 1882. The number of vaccinations under one year, as compared with the number of births, is as follows:—

	No. of Births.	No. of Vaccinations under 1 Year.
Europeans and Eurasians	492	231
Hindus and Native Christians	14,645	7,850
Mahomedans	1,854	887
	16,991	8,968

It thus appears that only one-half of the children born in Madras are protected against smallpox within a year of birth.

The following figures show improvement in the results of vaccine operation:—

	1880.	1881.	1882.
Ratio of successful cases to the total operated	86·1	89·4	89·7
Ratio of unsuccessful cases to the total operated	7·1	6·3	6·0
Ratio of unknown cases to the total operated	6·8	4·3	4·3

With a view to encourage vaccination, the Commissioners have determined that no result grants shall be given by the municipality on account of any school pupil who has not been vaccinated, and the managers or masters of schools are similarly required to be vaccinated. The Deputy Inspector visits the schools and gives the necessary certificates at suitable times.

ABSTRACT OF REPORT OF THE MUNICIPAL COMMISSIONER FOR THE CITY OF BOMBAY FOR 1882.

(Surgeon-Major T. S. Weir, Acting Municipal Commissioner.

Sanitary works. Drainage.

The new main sewer from Carnac Bridge to Love Grove was completed in 1881, but in December 1882 a connexion was made at Bellasis Bridge between this new sewer and the old drain; and the sewage of the city which flowed into "Aitken's new low-level sewer" from the old drain, has been diverted into the new main sewer and flows to the new pumping station at Love Grove. If sewage flows to the new pumping station through the new main sewer the old pumping station will not be required, it will be removed.

Sewage was admitted into the new main sewer in December last, but owing to the uncertain pumping of new machinery not perfectly adjusted, and the cessation of pumping for adjustments, it was not possible to admit sewage continuously until March 1883. Since March 1883 sewage has flowed continuously down the new main sewer, and been pumped continuously through the new pumping station to the sea. There has been a remarkable abatement of the nuisance at Love Grove, and if sewage is not carried through the old pumping station and channel of outflow, there will have been, through sanitary execution, an extraordinary removal of ancient and potent nuisances in causation coeval with the growth and development of the city.

The nuisance at Love Grove, from the old system, was aggravated by the proximity of outflow and the flowing of sewage into the open channel. Had the outfall of sewage been more seaward, and the stream of sewage to the outfall been unbroken, and no foul streams fallen into the open channel, the nuisance at Love Grove would have been less; the exclusion of sewage from the open rain-water channel during the monsoon storms will depend upon the completion of the drainage scheme, and the power of the pumping engines to cast off flushes of diluted sewage.

The repair of the encasement of the outfall sewer from Love Grove was completed on the 11th November. The progress of this work was necessarily slow, but it was continuous. Mr. Walton (Executive Engineer) writes on this work of stabilitating the outfall of sewage:—"The whole of the cast-iron piping has now been encased with rubble-"masonry laid in Portland cement, and the top of the mass plastered with Portland "cement to a distance 675 feet from the seaward face of the outlet-well. Beyond this "distance the sea never recedes from the work, and therefore the system adopted for "the higher portions is not applicable to the lower length. This length is only 56 feet, "and as it is not subject to the twice washing at every tide which the other parts have "to undergo, it is not probable that the original work (cement concrete deposited in "bags) will be disturbed. The bank is now strong and neat, and it may be confidently "anticipated that it will be unaffected by future south-west monsoons, except in so far "as all marine structures occasionally suffer to some extent."

In the last Annual Report the Municipal Commissioner drew attention to the slow and not satisfactory progress in the execution of the pipe sewer works, and in this annual report a more favourable description of the progress during the past year cannot be given. The portion of the work to be executed first and by contract has now been nearly done, but there are other portions to be done, and why the execution of these portions has to be deferred, is thus explained by the Executive Engineer, "that these "sections are designed to run through very narrow lanes,—nearly the whole width of "which is now occupied by masonry drains, which will necessarily have to be entirely "broken up for the laying of pipe sewers. If this course were pursued now, the "masonry drains would have to be reconstructed as a temporary provision for carrying "off the sewage, while if the laying of the pipe sewers be deferred until the house "fittings and down-take pipes are being fixed, the sewage can be passed at once into "the pipe sewers, and the masonry drains will not be required. The storm waters of "these narrow lanes may very well pass over the surface."

As I anticipated, it has been observed that the construction of the sewers of the first portion of the drainage scheme has affected the circulation and level of the subsoil water; this is the first, and a most important effect of the drainage scheme; the subsoil

water has been lowered in the areas intersected by the arterial system of connected and graduated underground channels, inclining and falling to the outfall at Love Grove. Water in reservoirs and wells has sunk; it has been reported that in positions where much water was found before construction of sewers little water is found now.

The foundations of the building for the new pumping station at Love Grove were erected in 1881; in 1882, a contract was entered into for the erection of the building. The building was commenced in January 1882; it was not completed at the end of the year 1882; it was so far advanced in July 1882 that the erection of the engines began; the first pair of engines were tried in December 1882; the trial was not successful; improvements had to be made; alterations were effected, and in March 1883 the first pair of engines were pumping steadily, and the discharge of sewage from the old pumping station was stopped. As I have already pointed out, a remarkable abatement of the nuisance at Love Grove was observed on the cessation of pumping at the old pumping station. I may mention that a special committee of experts was appointed by the Municipal Commissioner in January 1883, to report on the new engines and machinery. The committee met several times, and, after a careful examination of the machinery, suggested certain mechanical alterations and additions; the suggestions of the committee were adopted; the alterations enabled the engines to be worked more perfectly, but I am informed by the Executive Engineer that the machinery had not, at the close of the year, been placed in the state of order he approved of. The second pair of engines were in course of erection, and will be in working order by the middle of May.

A scheme of surface drainage was sanctioned in 1882, and its execution has been commenced; the scheme consists generally of the following projects:—

a. Raising the level of the roads in Khetwady.
b. Raising private compounds in Khetwady.
c. Three branch drains in Khetwady.
d. Raising manholes and sewers.
e. Intercepting drain from Gowalia Tank to Khamballa Hill.
f. Intercepting drain from Pydhonee to Bellasis Road.
g. Enlarging old open main drain.
h. Diverting Tulsi pipe, line of.
i. Filling up the culvert of Haines Road.
j. Construction of reservoir on the Flats for storm waters.
k. Formation of storm water openings.

The most important sanitary results may be expected from this scheme of surface drainage; if executed completely, a great improvement in public health, and the amelioration of the condition of many portions of the city, may be expected.

The storm water drain from Pydhonee along Bellasis Road to the old open main drain at Bellasis Bridge will intercept the storm waters which flow to Parell Road, and lead them to the open main drain and the storm water reservoir on the Flats.

The large storm water drain from Gowalia Tank by Tardeo, included in the scheme, is an important outflow for storm waters, it will be connected with the open drain artery of the storm water reservoir; this drain will also intercept a large volume of water which, during heavy rain, falls to Khetwady. The deplorable condition of the district of Khetwady at periods of the rains is known—streets submerged, buildings surrounded by water, dwellings wet, and the unwholesomeness that follows; the elevation of the ground of Khetwady, the construction of channels to carry away rain water that would have flowed to Khetwady, and more perfect channels for the removal of the storm water, will diminish the wetness of the district.

A separate contract was entered into for raising the roads and ground of Khetwady; the contract time allowed for the completion of this work expired on the 12th December 1882, but, owing to the construction of a portion of the Queen's Road sewer which passes across one of the roads to be raised, the contractors have been unable to finish the work in the contract. The Executive Engineer is of opinion that the progress of the surface drainage has been on the whole moderately good.

I would draw attention to the remarks, in the report of the Health Officer, from me on the reservoir for storm waters:—"The construction of a reservoir to hold storm waters "till they can flow away has been advocated for many years, and although the forma- "tion of a basin on the borders of the city to collect the rain waters may be regarded "with some anxiety, it need not, if the water is constantly changed, and its depth sure, "and the basin closely observed, excite alarm; the possibility of alarm points to the "necessity of the closest observation of the reservoir; the formation of a reservoir "to prevent the rain waters falling back to the depressed portions of the city appears "unavoidable."

The expenditure for the construction of a very important sewer, to intercept the sewage falling into Back Bay and to convey it to the new arterial system discharging at Love Grove, was sanctioned. The sewer is estimated to cost Rs. 1,92,000. The Corporation have given Rs. 1,42,000 of this sum, and Government, considering the special value of the sewer, have contributed Rs. 50,000. A contract for the construction of the sewer was entered into in November 1882. This sewer is spoken of as the Queen's Road intercepting sewer. It will extend from a point near the Marine Lines Hospital to the sewer of the new system in Khetwady Back Road. The construction of this sewer has enabled the Municipal Commissioner to form an important road between the Girgaum Back Road and Khetwady Main Road. This road will be an important and useful thoroughfare between two large lines of traffic. It has been very much required. It will be 50 feet wide. The construction of the sewer is progressing.

A contract was given, in March 1882, for the construction of the sewers of the Kamathipura drainage scheme. The work has been nearly finished. The main sewer lines have been completed. The branch tributary lines have to be constructed. The progress has not been so rapid as was expected. The placing of branch pipes in gullies was commenced as soon as material had been received from England, about the end of June, and continues. The placing of pipes in gullies carrying sewage has been disagreeable work, but not more disagreeable than was to be expected. The Executive Engineer writes as follows of the experimental privies that have been erected in Kamathipura:—

"In the early part of the month of December a large house (No. 36 Kamathipura 12th Street) containing 3 privies and 29 nahanies was wholly connected with the sewer by the new system. The place of drawing water was also connected by a syphoned gully trap. At the same time four nahanies of neighbouring houses, which naturally come within the same arrangement, were connected. Through house No. 36, under the ground-floor, a masonry drain ran, imperfectly covered, and in direct untrapped connexion with several nahanies. The sweepers' passage for removing the night-soil from the privies was within the house, under the floor of upper rooms.

"The drain and the sweepers' passage have been entirely done away with. The privies act exceedingly well, and are so much approved that the people in large numbers from the surrounding neighbourhood use them in preference to their own. On one day, a census having been taken, it was found that as many as 129 persons used the privies between morning and night. The occupiers of the house state that they never perceive any smell from either the nahanies or privies, and the municipal officers, who have from time to time visited them with the express object of endeavouring to find a defect, testify to the same effect.

"Two privies and four nahanies, besides two outdoor sinks, of a bungalow occupied by Mr. Ardaseer Framje Moos have also been connected with the sewer, and all are acting perfectly, and entirely free from smell.

"The nahanies of two houses in Kamathipura Centre Street, and of one house in Khursetjee Suklajee Street, and also the municipal stables of the Health Department, and several buffalo stables and outdoor sinks, have been connected with the sewers, and are in perfect action. The stables and sinks have been connected by gratings and syphoned gulley-traps."

The privies are the most useful and the best calculated to meet the wants of this diverse population I have seen. They, however, require to be used intelligently. The conception is, I think, good.

Water supply.

The time for the completion of the John Hay Grant reservoir expired in August 1882, but in consideration of the contractors having unexpectedly met with a large quantity of rock, an extension of nine months for the completion of the reservoir over the contract time was granted by the Municipal Commissioner. In connexion with this reservoir, contracts have been entered into for laying 48", 32", and smaller mains.

Tenders were invited, and a contract was entered into on the 3rd April 1882, for the construction of filter beds in the Malabar Hill Reservoir. The contract time for the completion of the works expired on the 18th of April 1883. The work, up to the end of the financial year, only represented 30 per cent. of the whole work. The work, therefore, cannot be completed within the contract time. The measures to be taken against the contractors for having failed to fulfil the contract have been considered; the penalties the contractors are liable to will be inflicted. It is of great importance that the filter-beds should be completed. The Tulsi Lake is small, the water drawn off drains too deeply the lake. As water from the Tulsi Lake is drawn off, the impurities in the water left in the lake must increase; the impurities are concentrated as the lake diminishes, and the evidences of vegetable contamination increase with the advance of

the hot season. The impure condition of the water each season excites alarm; a recurrent panic is felt. The impurities can be oxidized or intercepted by filtration.

The rainfall at both Vehar and Tulsi was scanty. The total rainfall on the gathering ground of the Vehar Lake during 1882 was 54·63 inches, against 59·10 inches in 1881, and the average for the previous five years of 78·21. The level of the lake at the commencement of the monsoon was 43·10 feet, and at the close 51·90, against 46·3 and 54·7 at the commencement and close of the monsoon of 1881.

The total rainfall on the gathering ground of the Tulsi Lake was 74·22 inches, against 86·11 inches in 1881, and the average of the previous two years of 89·93. The level of the lake at the commencement of the monsoon was 20·42 feet, and at the close 47·17, against 18·93 and 49·09 at the commencement and close of the monsoon of 1881.

There were four bursts in the 24″ Tulsi main during the financial year, but none in the Vehar 32″ main. There were several bursts in the smaller mains.

In connexion with the extension of the water-supply and financial possibilities (already much accounted for), I may recall attention to the fact that there are many properties to which water connexions have not been made, and from water connexions to which an appraisable income may be obtained. The number of houses without water connexions has been drawn attention to before, and the contingency of houses within the city not provided with water connexions escaping the incidence of the water-rate has engaged the close attention of the Municipal Commissioner. The tenants of houses without water connexions may obtain water from the pipes of neighbouring houses having connexions, and houses without connexions may thus escape the full measure of taxation and the incidence of the water-rate. An order was issued by the Municipal Commissioner to cut the water connexions to houses that are accessible to the occupants of other houses not having connexions, but belonging to the same owners, unless that the owners agreed to pay water-rate on the assessed value of all the houses having facilities for access to the water pipes. The consequence of this measure has been excellent; the owners of 204 houses that had no connexions, but the tenants of which had access to the water in other houses, have agreed to pay water-rates on the assessed value of their properties.

The use of meters has been encouraged. The waste-water prevention establishment, while examining some of the mains and pipes, detected great waste.

Conservancy. The departmental work of the Health Department forms a favourable record. On an average, 2,643 men and women were employed, and 463 scavengering and drain-cleaning carts, and 103 night-soil and cesspool carts were at work daily. 141,611 tons of garbage, against 136,867 in 1881, were collected. 262·2 tons of night-soil were removed daily, against 233·6 tons in 1881. 205·5 miles of covered drains, against 202·6 miles in 1881, were opened and cleaned.

ABSTRACT OF REPORT OF THE HEALTH OFFICER OF BOMBAY FOR 1882.

(Surgeon-Major T. S. Weir.)

Public health.

The health of the city of Bombay has been favourable during 1882; for seven months the public health was exceptionally good, and, had it not been for the resuscitation of cholera in the last month of 1881, and the prevalence of morbillous affections during the first quarter, the public health during the year 1882 would have been very good. Considering prior records and experiences, and all circumstances, it was more than favourable.

Compared with 1881 and the previous five years, there has been a great fall in the mortality; exclusive of still-born, 20,468 deaths were registered; the mortality is 1,388 less than in 1881, and as many as 4,740 deaths less than the average number of deaths in the five years preceding. The death-rate is equal to 25·8 per 1,000.

Progress in sanitary work.

The most important measure relating to the public health carried out in 1882 has been the system of surface drainage—finally approved of. This system involves the construction of a large reservoir to hold or collect surface waters till they can flow off, and the formation of a lake, 176 acres in extent, to the east of the Hornby Vellard, and where the sea once rushed in before the Vellard was built across the breach. In the lake there will be an average depth of six feet of water; the water will be changed at favourable states of the tide, and the sea water will be admitted and flow in and out. If there are no other means of preventing the rain-water from the surfaces inclining to the water-ways passing to the north, which will not flow off, setting back to the city, till it can flow away, the construction of the reservoir is unavoidable; undoubtedly, the reservoir will diminish the intensity and duration of flooding, and the collection of water in portions of the city to which storm-waters gravitate; the condition of the reservoir will depend on the care bestowed on it, and the constant changing of the water. Another important sanitary measure, arising out of the surface drainage scheme being carried out, the raising of the low-lying district of Khetwady; this measure would not have been advisable had not special storm-water drains been constructed; very important sanitary results may be looked forward to from the complete execution of the surface drainage scheme.

The construction of drains proceeds, but the branch and tributary drains still convey no sewage, as connexions from buildings or from gullies have not been made; except to a building in Kamathipura, house connexions have not been constructed. I cannot but express my regret that sewage has not been admitted into and carried through the new branch drains. This regret is the greater when I recollect the condition of the old drains in streets in which new drains are empty—the stagnation in the old drains, and the difficulties in removing the impurities of stagnation, and the street opening and obstruction. But the drains have not been altogether useless; they have been carrying storm and subsoil water, and the level of the water in the ground has been affected; the abstraction of subsoil water is indicated in the falling water in some tanks and wells, and suggests the cleansing of foul reservoirs and states of future cleanliness in tank conservancy; in future, tank conservancy will be a possibility; the repair of fine old tanks or well[illegible] become a reality.

Apparent[illegible] advantages can follow from the removal of tanks; there are, however, [illegible]ges and even dangers. I am not so sanguine as I have been hitherto as to t[illegible]dvantage of removing tanks; they afford breathing spaces or openings [illegible] impede building concentration; if emptied and filled with earth, [illegible]ay arise, there is no certainty that the gardens will remain; necessity [illegible] and gardens to be sold, that they occupied positions where once [illegible]ding common breathing room, being forgotten, and the breathing [illegible]ities may thus be lost. Tanks are also most valuable storm-water [illegible] any tank is removed it is necessary, I think, to be sure that the [illegible]ains or channels will remove the storm-water so quickly, that water [illegible]the tank will not flow around dwellings. For these reasons I advocate [illegible]n in the treatment of the tank reservoirs.

I hope that before the end of the next year wells will have been sunk for the special observation of the level of the subsoil water in the island.

During this year much attention has also been devoted to the condition of connexions between buildings and drains. In the last Annual Report I referred to the effects observed in one fine building in the Fort from direct connexion with a covered drain. This was a glaring instance of violation of sanitary principles, but another glaring instance has been found in a large building used as a Government office in the Fort. In this large building the pipes had all been directly connected with covered drains. This supports the view advanced in the last Annual Report, that the greatest care in future years will be necessary to prevent the direct connexion of buildings with covered drains. The temptation is great, and to the unprofessional mind the danger is not clear. The greatest portion of the population live in localities intersected for many years by covered drains, and the number of direct connexions may be inferred when it is remembered that the prohibition or removal of direct connexion has only recently been attempted; in 1882 proceedings had to be taken in 28 cases for disjunction of house connexions. It appears to me that the only sure method of ventilating connexions between buildings and covered drains is by open spaces dividing pipes. Even under certain conditions (an experience we had in the Fort shows this to occur), sewer air will be drawn through open spaces and attracted to buildings. If the true precautions laid down by Mr. Rawlinson are followed in making connexions with drains, it appears to me that there are no reasonable grounds of apprehension, and no practical danger of sewer air being carried to buildings.

I rather prefer the house connexions made in Dhobee Talao, there is the utmost disconnexion with impermeable pipe continuity.

The impure condition of the Tulsi water caused again in the hot season of 1882 much alarm. Towards the end of 1881 the water was becoming impure; in February 1882 the water was very impure, the amount of organic impurity was very large. In consequence of the impurity of the water, and evidences of much vegetable pollution, measures of filtration and interception were adopted; the reservoir was cleaned, and, to favour subsidence of the impurities in suspension, lime was thrown into the water. A sample of water collected from a pipe in the Fort yielded ·60 parts per million of albuminoid ammonia, but a sample taken six days afterwards, when the system of partial filtration and interception had been carried out, yielded ·45, and the albuminoid ammonia had fallen to ·22 parts per million, in a sample of water collected on the 22nd of May. I examined the lake on the 21st of May; the water was very impure, and contained large quantities of vegetable matter, and the water exhaled an unpleasant smell. It must, however, be stated, that the Tulsi water was not so impure as in the previous years, and I trust 1883 will be the last year of foulness. The impurity of the water arose from the exhaustion of the supply in the lake, and the concentration of impurities in the water left for distribution; the water carries down mineral impurities as it falls from the margin of the lake. I can only recommend the completion of the filtering beds, and the careful cleansing of the gathering ground; the opening of the lower outlet from the lake, as the first rain-water rushed in, for a short time, might remove impurities which lie at the bottom of the lake.

The covering of the surface reservoir has been approved of and decided on. I have been of opinion that the reservoir should be covered; sanitation is the accomplishment of the practicable for the public health, to keep from the water impurities most numerous in city air what is practicable will be done; it must, however, be a matter of opinion whether it is the best expenditure, the need on which expenditure was most needed; as a purely sanitary measure I have approved of it, although I must admit that there are other necessities more urgent.

The extension of medical relief to the poor at their houses, referred to in my report for 1881, has been recommended and ably advocated by Dr. Blanc; whether this year, or hereafter, I am convinced that not only a system of medical relief, but of poor law relief must be provided; this city is changing to a degree which [illegible] midst scarcely observe.

During the year I have been selecting positions for latrines and urinals, and offer a few remarks on the location of these necessaries. The public are sensitive as to nuisances, that it is difficult to obtain positions in the [illegible] localities for latrines and urinals; it will soon be impossible to erect latrines on the sides of the public streets, and it appears to me that ground [illegible] will have to be purchased on which to erect buildings to hold the latrines and in these buildings they will be concealed from view.

Dust boxes will also soon have to be placed in other positions than the public streets, or in other ways than open, near buildings. I would recommend that vacant ground, in all streets where plots of ground are unbuilt, on, be purchased for the location of latrines, urinals, and dust boxes. A large number of dust boxes will, I fear, have to be removed from positions in which they have been for years.

Vital statistics.

As in the previous year, the mortality consists of a low male and a high female death-rate; the male mortality is only 22·3 per 1,000, and the female mortality 31·1 per 1,000; in 1881 the male mortality was 24·9, and the female mortality 33·2 per 1,000; there is, therefore, a reduction of more than 2 per 1,000 in female mortality since 1881.

The mortality arranged according to groups of important death-causes is shown in the table which follows. There is a further reduction in the mortality from fevers amounting to 1·42 per 1,000; in 1881, the death-rate from fevers was 8·32 per 1,000, in 1882 it is 6·90; the deaths being 6,437 and 5,453. There is a greater mortality from measles, phthisis, and diseases of the nervous system, and a less mortality from cholera, diseases of the respiratory system, diarrhœa, dysentery, and all other causes.

Causes of Death.	Number of Deaths.	Rate per 1,000 of Population.	Remarks.
Smallpox	92	0·11	
Measles	991	1·26	
Fever	5,453	6·90	
Cholera	192	0·24	*Annual increment of population for the year is calculated.
Phthisis	2,729	3·45	
Diseases of Nervous System	2,557	3·24	
Do. Respiratory do.	3,402	4·30	
Diarrhœa	1,093	1·38	
Dysentery	525	0·66	
Accidents	346	0·44	
All other causes except still-born	3,088	3·91	
Total	20,468	25·89	

Another very favourable indication of the state of public health is, the absolute reduction in the mortality of children, notwithstanding an increasing population. In 1882 we find that 8,911 children under five years of age died, and in 1881 that a greater number (9,218) succumbed; the mortality in 1882 is 108·99, and in 1881 the mortality was 112·75.

Smallpox.

Although the mortality from smallpox in 1882 is little, only 92 deaths, and 315 less than the average of the previous 5 years, in December there were evidences of a resuscitation of smallpox that mortality was probable. There has been no serious epidemic of variola since 1876, although the resuscitation of the affection has been apprehended in more than one year.

Cholera.

In 1881, the mortality from cholera had been progressively diminishing, from July, through August, September, and October, till, in November, it fell to 9 deaths; from the 27th of October, till the 14th of November, there were no deaths from cholera, but on the 12th of November, three cases occurred; it is remarkable, that two out of the first three cases on the 12th of November had recently returned from the pilgrimage to Pandurpur. The mortality in the 4th quarter of 1881 was 114 less than in the 3rd quarter, but with the advance of December an increased prevalence and intensity was observed; in the first week of December four deaths were registered, in the last week 28. The disease had not assumed a decidedly epidemic type at the end of the year; its development during the first three months of 1882 is described as follows in the report on the 1st quarter:—"In the 1st quarter of this year, a maximum cholera intensity was "observed in the early part of January, and after the middle of February the disease "began to abate and to be intermitting in incidence; the monthly incidence, and more-"over, decline of mortality as the quarter advanced, is exhibited in this statement."

	Deaths.
January	82
February	52
March	17

"The chief points of concentration of incidence were in Parel village, in Moogbhat, in buildings built around an open space called Pimpulwady, and in Nacoda's Oart, Girgaum. I shall now refer to two of these points of concentration, Parel village and Pimpulwady. In Parel village and in Pimpulwady there was a strong presumption of connexion between impure well water supply and the concentration of cases; there were grounds for believing that the well water was a probable factor in both instances. In the Parel village, the well waters were supposed to be used only for washing and the cleaning of cooking utensils, they were, however, drunk; the water of one well in the centre of the village was very impure; the water of the second well near the Parel tank was suspicious, and exposed to contamination; under ordinary circumstances the water might be used. The water of the first well, in the centre of the village, was, I believe, contaminated from a privy; it was very impure, totally unfit for drinking. Both wells were at once closed, the first well has been covered over. The water of the well near the Parel tank is now allowed to be used for washing."

"Parel village has no system of drainage (the district has no system of drainage); the drainage is either received into cesspools or run into open channels, which discharge into low-lying ground; one portion of drainage soaks into the ground of Government House compound, and is so disposed of. I am glad to record that a drain is to be built, I hope this year, in one portion of the Parel district; it is that portion near the Gasworks, which I have described in previous annual reports."

"The water supply of Pimpulwady was very impure: Pimpulwady has only a well water supply and the well water had become deeply contaminated, probably from cesspool percolation. There are nine cesspools, and the nearest cesspool is 29 feet from the nearest well."

"The water of this well exhibited, on examination, distinct evidence of sewage contamination. Pimpulwady is not connected with any system of drainage or drains outside itself; the drainage, the sewage, and refuse waters, are received in cesspools; a new sewer under the new system has been constructed in Moogbhat, and I hope the drainage of Pimpulwady will be conducted to this sewer. The buildings in Pimpulwady were, on the whole, good, the rooms were well ventilated over each door, and at the top of each outer wall, bamboo slits to admit air; the plinth of rooms was good. The first case in Pimpulwady came from the neighbouring compound (in which a case of cholera had occurred), and died in the verandah of a building in Pimpulwady; he was the grandson of an aged female who died in the neighbouring compound before he had left it, from cholera. As the first case in Howdachiwady (the neighbouring compound) was a wool-cleaner by occupation, and as some of the cases in Pimpulwady were wool-cleaners and some of them worked in the same factory, I made inquiries regarding the place of wool-cleaning, and where the wool had been brought from. I ascertained that the wool had been brought from Kurrachee, and that it had been first sent to Coorla, where wool-cleaners had suffered from cholera, and from Coorla it had been sent to Bombay to be further cleaned."

"Having referred so far to the fatality of certain positions, I may now state, that in all 180 cases, 112 males and 68 females, were reported, of which 151 proved fatal. Of the total cases, 15 were born in Bombay, and 162 were born outside of Bombay. Of the cases born in Bombay, 12 died, and of the cases born elsewhere, 137 died. Of the cases born outside of Bombay, as many as 104 were born in Ratnagiri, and 89 died. The mortality according to place of birth is best exhibited in a tabular form":—

	Attacked.	Died.	Percentage of Deaths.
Born in Bombay - -	15	12	80·00
" Ratnagiri -	104	89	85·57
" all other places -	58	48	82·75
" unknown " -	3	2	66·66

"We further find that 54 of those attacked, 44 dying, were under three months' residence in the city."

"The mortality from cholera is equal to ·78 per 1,000. Examining the mortality according to class we observe that no cases occurred amongst Lingayets, Bhattias, Enrasians, or Jews; the highest mortality occurred amongst Hindu low-castes; one death amongst Europeans was registered."

"Examining the distribution of the mortality from cholera over the city, by districts, or sections, as they are called, we observe that in five sections no deaths from cholera were registered; these sections of exemption were Fort South, Tarwady, 1st Nagpada, Mahim, and Worlee. The highest mortalities were registered in Upper Colaba, Chowpatty, and Girgaum."

This is the record of the prevalence and mortality from cholera in the 1st quarter, and it is practically the record of the whole year, so far as any epidemic phase; in April only 5 deaths occurred, in May 1, and in June none; in July and August sporadic cases reported 12 deaths in each month, and in September 8 deaths, followed by disappearance of cases in October, none in November, and only one death from cholera in December. There were therefore two months in 1882 in which no deaths from cholera occurred, and two months of one death each, and one month having a mortality of two.

In the extract from the first Quarterly Report I have given, relating the incidence of cholera during the first three months of the year, it will be observed that a greater number of cases and a greater number of deaths occurred amongst the classes born outside of Bombay Island than amongst the classes born within the island. Of the total 180 cases reported in the first quarter, 162 occurred amongst populations not born within the Island of Bombay, and of the mortality of 151, as many as 137 were not born within the island.

The experience of the first quarter corresponds with the experience of the whole year; 212 of the total 236 cases, and 173 of the total 192 deaths, were not born within the Island of Bombay, the few deaths in the third quarter affecting proportion of strangers. During the year 236 cases were reported, and 192 ended fatally, equal to 81 per cent. This mortality gives a death-rate of ·2 per 1,000 of population: in 1881, 703 cases were reported, and 546 proved fatal.

An illustration of the growth and external development of this city is found in the period of residence of those who suffered from cholera; 66 were under three months in the city, and 54 succumbed, 16 were over three and under six months, and 15 died.

As in the previous year the highest mortality from cholera occurred in undrained districts, Colaba and Chowpatty, and the next highest mortality in another undrained district—of the second highest fatality in 1881; Girgaum occupies really the second position in 1882, as in 1881. In four districts there were no deaths from cholera, the Fort South, 1st Nagpada, Mahim, and Worlee.

The conditions amidst which groups of cases arose were generally those conditions observed surrounding outbreaks in 1881; there has been a distinct intensity manifested in particular districts and around particular centres of population, but the incidence of the mortality from cholera, and of the total mortality, have not fallen uniformly and with uniform severity throughout the districts of the city; sections of the highest total mortality are not sections of the highest cholera mortality. The chief predisposing influence appeared to be of an individual—constitutional nature, so to speak; the most general conditions, I observed, surrounding groups of cholera cases were as in 1881, shortly "dampness—dampness of ground—of walls, imperfect ventilation and resulting "air impurities; the exciting agencies of greatest potency, inasmuch as of most "frequent occurrence, appeared to be dampness—humidity, which implies soil saturation "and pollution arising from imperfect channels for removal of sewage—sewage stagnation "and soil saturation and pollution being in the relation of cause and effect—air impurity "and darkness arising from defective ventilation and lighting, dwelling and surface "crowding." The precautions adopted aimed at cleanliness in its widest sense so far as practicabilities; the more cleanliness—the more perfect prevention, the more possibility of cleanliness, the more prevention—experience in combating disease in this city indicates.

Fevers.

There is again this year a large decrease in the mortality from fevers. In 1881 the mortality from fevers was 1,075 less than in 1880, and in 1882 the mortality from fevers is 3,581 less than the average of the previous five years, and 984 less than in 1881. This great reduction may, in some degree, be due to more accurate registration of the causes of death, but the reduction remains a fact. Of the deaths from fevers 4,188 are referred to remittent fevers, being 896 less than in 1881, and 4,053 less than the quinquennial mean; in 1881 the mortality from remittent fever was 1,780 less than in 1880; to simple continued fever 927 deaths are referred, being 527 more than in 1881; and to ague 316, being 626 less than in 1881; the greater attention given to the diagnosis of typhoid fever is evidenced in the greater number of deaths ascribed to this affection, 22 were referred to typhoid fever, against 11 in 1881; and I can only write, as in 1881, that the mortality registered from typhoid fever simply indicates the number of cases identified by medical men to be suffering from typhoid fever. An outbreak of

typhoid fever in an educational institution on the open space—the Esplanade—has been described in an interesting paper read before the Medical and Physical Society by Dr. Carter, and published in the Transactions of the Society. There were in that large building in which the cases occurred serious sanitary defects; I have at different times inspected the building, and some years ago I wrote a report on the condition of the privies and their imperfect drainage, and recommended that the privies should be removed and built at a distance from the building. The fæcal matter was received in baskets—dropping through pipes—in a covered space open at one end east side underneath building; the authorities were most anxious to improve the privies, but they were not able to procure ground close to the building to build new privies on; improvements such as were possible were effected, glazed pipes to carry down excreta to iron receptacles, from receptacles solids being removed in baskets; large well constructed cesspool built to receive liquids; cook-room was removed further from privies, and space underneath building, in which receptacles for fæcal matter was placed, better ventilated and lighted; but any covered space in which are placed receptacles to receive fæcal matter, and into which shafts, even glazed, discharge fæcal matters, must be offensive, and this covered space, clean as it was kept with plentiful washing and deodorization, had an offensive animal odour; pipes, and more especially pipes not laid on system, having no cisterns to be flushed by, through which fæcal matter falls, unless flushed at time of use with plentiful flushing, must become foul, fæcal matter adhering to and coating them. In the privies in this institution, there was not the great safety against putrid organic exhalation which exists in privies in the town—which is this—place for reception of fæcal matter exposed to light and air, but there was sufficient ventilation to excite changes—not sufficient to destroy products of change.

As in the previous year, the female mortality from fevers is higher than the male death-rate; but the excess is very little, in 1882 rate of female mortality being 7·9 to 6·4 male mortality per 1,000 of population. The high mortality from fevers at early and late periods of life may in some measure be due to imperfect registration of causes of death.

Some cases of relapsing fever occurred during the year, and they indicate that, unless conditions favourable to the spread of the disease exist, the importation of cases will not lead to the genesis of an epidemic. A group of seven cases suffering from relapsing fever, or from fevers of a relapsing type, were admitted into the Gokuldas Tejpal Hospital; they had landed from a ship (having come from Mecca), and on landing were refused residence in one building, and were taken to the Police Office and sent to hospital; they had suffered on board ship from bad food and bad water. A group of three cases, reported by Dr. Cody, in a paper read before the Medical and Physical Society, were taken from a wretched "chall" in Mody Bay; the "chall" has been removed in consequence of its unwholesome arrangement and condition. Another case was reported in a wretched hut, under the walls of the Fort, close to hospital, the patient a Mahar—hut-dweller.

The highest mortality from fevers has been registered in Parel section equal to 12·7 per 1,000; high as this mortality is, it is less than in 1881, when the mortality from fevers was 13·8. I would refer to remarks on drainage of Parel in section of report on cholera. The mortality has fallen in Sewree from 18·7 in 1881 to 8·1 in 1882; this is satisfactory. Continued efforts have been put forth during the year to remove the rank vegetation very likely to be concealed, and also collected by cultivators in thinly populated and hilly sections, such as Sewree and Seo.

In Mahim and Worlee there has been a prevalence of fevers, and therefore an upward death-rate is registered, and the evidence I collected and examined—a large number of facts and statistics—appears to me to point to these fevers as arising from conditions of dampness and moisture, and changes which these conditions produce. In Mahim fevers have been most prevalent and fatal on the east side of the district, and where the ground dips to batty fields. The construction of channels to remove even the excess rain water in all the outlying districts is most necessary. This was written in 1881, "I would again "draw attention to the absence of drainage in the outlying, and moreover in many parts "of the city itself; it is not a question (in many portions of the city) of which form of "drainage is the best to be adopted, it is a question of any channels, however rude, to "carry away the sewage from the dwellings of the people, so that the health of the "population may not be tainted."

Other diseases.

The increase in phthisis in 1882 over 1881 very nearly corresponds with the decrease in 1881 following 1880; 2,729 deaths were referred to phthisis, 497 more than in 1881; the highest mortality occurred in 2nd Nagpada; Khara Talao, a district of high

phthisical mortality, occupying second place. I shall observe with great interest the effect of the portion of the drainage scheme executed, and the surface drainage, on the mortality from phthisis.

With the subsidence of cholera, there is a diminution in the mortality from diseases of the digestive system, which are 1,249 less than the average of the last five years, and 421 less than in 1881; there is the greatest reduction in diarrhœa, 1,093 being referred to this cause, 248 less than in the last year, and 121 less than the average; 525 deaths were referred to dysentery, 196 less than in 1881, and 902 less than the average of five years; to all other diseases of the digestive system 527 deaths were ascribed.

From diseases of the respiratory system 3,402 deaths were registered, 397 less than in 1881, but 820 more than the average; 2,061 were referred to bronchitis, 114 less than in the preceding year; 986 to pneumonia, 41 less than in 1881.

From diseases of the nervous system 2,557 deaths were registered, 299 more than in 1881, and 428 more than the mean; 1,897 were referred to infantile convulsions, against 1,681 in the preceding year.

Births.

During the year 15,366 living births and 1,594 still-born births were registered; of the children born living, 7,945 were males and 7,421 females; the proportion of male to female births is as 107 to 100; the birth-rate is equal to 19·8 per 1,000. The highest birth-rate is registered amongst Eurasians, 72 per 1,000; of the large communities the highest birth-rate is registered amongst Parsees, 30 per 1,000, against 27 in 1881.

APPENDIX.

No. 1.

MEMORANDUM of the ARMY SANITARY COMMISSION on the REPORT of the SANITARY COMMISSIONER with the GOVERNMENT of INDIA for 1882.

1. The first section of this report is devoted to an interesting general summary of Indian climates for 1882, prepared by Mr. Blandford, F.R.S., Meteorological Reporter to the Government of India. But its practical data for our purposes begin with Section II., in which are discussed the sanitary statistics of the Indian European Army.

The following were the general results for 1882:—

Strength			57,269
Admissions			82,747
Daily sick			3,736
Deaths			694
Invalided	for change	985	1,892
	for discharge	694	
	uncertain	213	

These numbers afford the following ratios per 1,000 strength:—

Admissions	1,445
Daily sick	65
Deaths	12·07
Invalided	33
Total loss	45

When compared with the old ratios, with their average death-rate of 69 per 1,000, which ruled before the date of the Royal Commission on the Sanitary State of the Indian Army, these data are very remarkable.

Something in India, as elsewhere, must be allowed for what are called healthy seasons. But 1882 was a great epidemic year among the civil population, and yet all its army ratios have shown marked reductions, with the exceptions in the next abstract. The death-rates, admission-rates, and total loss are the lowest on record. Its daily sick ratio had been the lowest since 1879, and, with the single exception of 1880, its invaliding rate was also the lowest hitherto recorded.

2. The general statistics of the army of India, as a whole, for the last 13 years have stood as follow:—

Years.	Strength.	Ratios per 1,000 Strength.				
		Admissions.	Daily Sick.	Deaths.	Invaliding.	Total Loss.
1870–79	57,416	1,475	60	19·34	48	62
1878	56,473	1,651	68	21·46	45	66
1879*	49,582	1,977	78	24·28	49†	73†
1880*	51,796	1,789	74	24·85	26†	51†
1881†	58,728	1,605	70	16·86	38	55
1882	57,269	1,445	65	12·07	33	45

* Excluding troops serving in Afghanistan. † Including troops in Afghanistan.

Although in the years 1879 and 1880 the deaths do not include those in the field, they show the influence of field service on men who were taken ill and died after their return from Afghanistan to the stations.

The following abstract gives the inefficiency rates for each presidency European army in 1882:—

Armies.	Strength.	Ratio per 1,000 Strength.				
		Admissions.	Daily Sick.	Deaths.	Invaliding.	Total Loss.
Bengal	35,164	1,579	69	13·17	35	48
Madras	11,020	1,058	57	10·25	24	34
Bombay	11,085	1,405	61	10·37	36	46
India	57,269	1,445	65	12·07	33	45

The death-rates in the armies of Bengal and Bombay are the lowest which have been recorded, and the Madras rate, 10·25 per 1,000, exceeded the hitherto lowest rate, 10·18 per 1,000 in 1880, by ·07 per 1,000.

3. The Bengal death-rate is the average rate for all the stations; but the sanitary history of this presidency will be better shown by giving the death-rates for groups of stations for two ten years' periods compared with the rate for 1882, leaving aside the disturbing influence of the Afghanistan war years.

Stations in	Death-Ratio per 1,000 Strength.		
	1860 to 1869.	1870 to 1879.	1882.
Bengal proper	29·57	14·43	11·19
Gangetic Provinces and Oudh	28·59	20·06	22·61
Meerut and Rohilcund	26·61	18·31	8·86
Agra and Central India	38·48	18·41	10·51
Punjab	25·24	20·71	12·12
Hill stations	14·78	12·23	8·65
Presidencies: —			
Bengal	29·98	21·00	13·17
Madras	—	17·69	10·25
Bombay	—	15·27	10·37

The rise in mortality in the Gangetic Provinces and Oudh in 1882 over the previous averages, and from 15·94 per 1,000 in 1881 to 22·61 per 1,000 in 1882, was mainly due to the severe cholera epidemic in these provinces, and to a great increase of enteric fever at certain of the stations. Taking the facts as a whole, they nevertheless show very satisfactory progress in improving and maintaining the sanitary standard all over India.

4. If the inquiry be carried further we shall find great differences in the death-rates of individual stations, and these differences of a somewhat unexpected kind, and not altogether in accord with the past sanitary history of the stations. Who, for instance, would have expected to find such a station as Jullundur yielding a death-rate in 1882 of no more than 1·25 per 1,000 out of a strength of 797 men, or Ahmednagar a rate of 2·12 per 1,000 out of 476 men, or Poona and Kirkee a rate of 2·85 per 1,000 out of 1,757 men? Leaving out all hill stations and hill depôts, and three small stations from which no deaths were returned, and dealing solely with stations yielding death-rates under 10 per 1,000, we find 31 such, accommodating 25,011 men in 1882, returning 180 deaths, equal to a rate of 7·2 per 1,000.

On the other hand, taking 34 stations with death-rates above 10 per 1,000, there are 22,822 men at these stations, of whom 398 died in 1882, affording a death-rate of 17·4 per 1,000.

These figures only give information for a single year, but they include the sanitary problems of military stations in India, except that the deaths at the stations afford different ratios every year. Low death-rates among half the troops and high death-rates among the other half yielded the annual average mortality for 1882.

5. In pursuing the analysis we find that certain stations were signalised in 1882 by very high and excessive death-rates. No fewer than 12 stations yielded death-rates exceeding 20 per 1,000, and it is right that these should be shown separately. They were as follows:—

Stations.	Strength.	Deaths per 1,000.
Aden	781	20·49
Cawnpore	954	26·96
Nusseerabad	677	23·63
Asirgarh	122	24·59
Attock	146	27·40
Indore	101	29·70
Dera Ismail Khan	90	33·33
Fyzabad	800	38·75
Benares	399	40·10
Fort Lahore	120	41·67
Sitapur	344	66·86
Chunar	74	81·08

We have quoted these ratios from Dr. Stephens' tables as matters of fact, but, in estimating their significance, the strengths should be taken into account, and in several instances these are too small to afford reliable indications of the sanitary condition of the smaller stations individually. But the influence of high local rates on the average army mortality is shown by the fact that these 12 stations were occupied by 4,608 men, of whom 146 died in the course of the year, equal to a death-rate of 31·6 per 1,000.

6. We have seen that the daily sick-rate averaged 65 per 1,000 for the whole Indian army in 1882. But this average, like the average death-rate, included such extremes as the following:— Asirgarh, 24·6 per 1,000; Aden, 32; Cannanore, 41·9; Deesa, 50·8; Fort William, 63·3; Muttra,

73·6; Rawal Pindi, 82; Fyzabad, 95; Neemuch, 105·7; Sitapur, 107·6; Meean Meer, 108·5; Morar, 112·2, the highest rate of the year.

7. Of the more fully occupied stations, Cannanore had an admission-rate of 850·6 per 1,000, one of the lowest rates of the year; Poona and Kirkee 911·2 per 1,000, from which ratios the admission-rates increased at different stations until we find at the opposite extremity of the scale Fyzabad, with an admission-rate of 2,132·5 per 1,000; Morar of 2,771·2 per 1,000; Delhi of 3,625·9 per 1,000, a rate which was somewhat exceeded in smaller stations, while, as has been already stated, the average admission-rate for the whole Indian-European army was 1,445 per 1,000.

8. We shall next state briefly the diseases to which these rates were assigned, beginning with the data for the whole Indian-European army.

Diseases.	Total Deaths.	Deaths per 1,000.
Cholera	61	1·07
Small-pox	4	·07
Enteric fever	146	2·55
Remittent fever	32	·61
Continued fever	3	
Intermittent fever	4	·07
Apoplexy	49	·85
Delirium tremens	3	·05
Dysentery	33	·57
Diarrhœa	4	·07
Hepatitis	80	1·40
Respiratory diseases	43	·75
Heart disease	26	·45
Phthisis pulmonalis	34	·59
Dropsy, scurvy, anæmia	4	·07
Wounds and accidents	10	·17
Suicides	37	·65
All other causes	118	2·07
Total	691	12·07

It will be observed that a large proportion of the mortality in this table is assigned to common causes not specially connected with Indian service or Indian climates.

Of Indian diseases enteric fever was the more important. Hepatitis, cholera, dysentery, and apoplexy occasioned many deaths, and as these are the more important death causes, it is necessary to show their comparative prevalence in the presidencies, which was as follows, in 1882:—

Diseases.	Death-rates per 1,000.		
	Bengal.	Madras.	Bombay.
Enteric fever	2·90	2·09	1·90
Hepatitis	1·48	1·72	0·81
Cholera	1·28	0·83	0·63
Apoplexy	0·94	0·82	0·63
Dysentery	0·77	0·36	0·18
Remittent and continued fever	0·74	0·27	0·54
Total	8·11	6·08	4·69
All causes	13·17	10·25	10·37

The more fatal diseases were all more prevalent at Bengal stations, where the febrile group occasioned a death-rate of 3·64 per 1,000 against a corresponding rate of 2·36 per 1,000 in Madras and 2·44 in Bombay. Dysentery was twice as fatal in Madras as it was in Bombay, and above four times as fatal in Bengal as in Bombay. The death-rate from hepatitis was, as usually happens, highest at the Madras stations.

9. We shall next compare the death-rates from the more fatal diseases for a series of years, to show where the reductions of mortality have taken place in each presidency, beginning with cholera.

Years.	Cholera Deaths per 1,000 annual Strength.		
	Bengal.	Madras.	Bombay.
1860–69	9·24	—	—
1870–79	4·18	1·68	1·55
1880	4·81	0·10	—
1881	3·23	1·73	·30
1882	1·28	·82	·58

Data for the first group of years are not available for Madras and Bombay, and the figures for 1879 and 1880 are disturbed by the Afghan war, part of the cholera mortality being excluded, and

part of the 1879 epidemic deaths included under the second group of years. But there is no mistaking the results of these figures, which show a great diminution of liability to cholera among European troops, in Bengal especially.

10. The most fatal disease in 1882 was not cholera, but enteric fever, the deaths from which were more than double those from cholera. There were altogether 146 enteric fever deaths in 1882, yielding a death-rate for the whole European army of 2·55 per 1,000, and to this fever-rate must be added ·68 per 1,000 deaths from intermittent, remittent, and continued fevers, raising the total fever-rate of 1882 to 3·23 per 1,000. The proportion of fever mortality in each presidency for 1882 was as follows:—

Fevers.	Death-rates per 1,000.		
	Bengal.	Madras.	Bombay.
Enteric fever	2·90	2·09	1·90
Other fevers	·77	·27	·81
Total	3·67	2·36	2·71

It is clear from these data that the febrile group was the cause of the largest number of deaths under one head in the course of the year, and the next abstract shows that there has not hitherto been the same reduction of fever death-rates as of those from cholera.

Years.	Bengal, Deaths per 1,000.		Madras, Deaths per 1,000.		Bombay, Deaths per 1,000.	
	Enteric Fever.	Other Fevers.	Enteric Fever.	Other Fevers.	Enteric Fever.	Other Fevers.
1870–79	2·28	1·74	1·42	0·62	1·75	1·14
1880	3·07	2·66	1·36	0·39	5·76	3·23
1881	2·62	0·81	0·58	0·19	2·88	0·91
1882	2·90	0·77	2·09	0·27	1·90	0·81

The Bengal fever-rates are persistently high, as they are also in Bombay. In Madras there is a tendency to reduction in the fever mortality. It would apparently follow from this table that if young age is the chief cause of enteric fever in India there must be a larger proportion of such ages in Bengal than in the other presidencies.

11. *Small-pox* shows its presence very irregularly in the army. During 23 years preceding 1882, and including it, there had been 1,185 cases and 181 deaths from this disease in the Bengal army. But of these numbers 848 cases and 132 deaths took place in the first decade of the series. The second decade, 1870 to 1879, yielded 294 cases in the Bengal army and 45 deaths. 1880 had 1 case not fatal, next year there were 4 non-fatal cases, but in 1882 there were 38 cases and 4 deaths from small-pox in the same army.

We have corresponding data for the Madras and Bombay armies for 13 years, in the first decade of which, 1870 to 1879, there were 55 cases and 10 deaths in Madras, and 59 cases and 5 deaths in Bombay. 1880 yielded 1 non-fatal case in Madras, but 9 cases and 3 deaths in Bombay. During 1881 there were 9 cases, 1 fatal in Madras, and 2 non-fatal cases in the Bombay army, which moreover escaped the disease altogether in 1882, while the Madras army yielded 6 non-fatal cases.

12. From this *resumé* of the sick and death rates from the so-called zymotic class of diseases, it will be seen that the diminished death-rates of late years have been due mainly to abatement of cholera. But the great diminution which has taken place since the older death-rates passed away appears to have been due mostly to generally improved health in the European Indian army as a whole.

What chiefly concerns our work at present is to do what may be possible to lessen the amount of sickness and death from prevailing diseases, especially from enteric fever, which is by far the most fatal of them, and we shall state the main points of interest regarding this fever as we have done in former years, beginning with the question of soldiers' ages.

13. The following was the constitution of the Indian European army according to age on the 1st July 1882:—

Ages.	Numbers.	Per cent. of Total.	Average of 1876 to 1880.
Below 20	1,961	41	36
20 to 24	21,653		
25 to 29	20,696	36	34
30 to 34	8,964	15	16
35 to 39	4,052	8	14
40 and upwards	779		
Total	58,105	100	100

The most notable feature in this table is the increasing proportion of men of the younger ages, which, as will be seen, is simply due to removing 7 per cent. from the ages above 30, adding 2 per cent. of this proportion to the ages between 25 and 29, and the remaining 5 per cent. to the ages under 24, the total strength remaining the same. In other words the missing 7 per cent. above 30 has not been made up by passing the required number of men from the younger ages to the older ages. These latter have quite disappeared, and the general strength of the army has been kept up at the younger end of the scale. The facts would apparently show the influence of short service in arresting the upward current of the younger ages. This influence is also visible, so far as it can be seen from a single year's experience of the length of service as follows:—In 1881 the per-centage of men who had served above 3 years was 16. In 1882 this per-centage had fallen to 13. The per centage of men above 5 years' service had increased from 14 in 1881 to 15 in 1882, that is, 1 per cent. The remaining 2 per cent. was added on to the periods of service under 5 years, which had increased from 70 per cent. in 1881 to 72 per cent. in 1882.

14. The influence of the element of age on the death and invaliding rates of 1882 is given in the next abstract.

Ages.	Deaths.*		Invalids.		Invalided per cent. of the total Invalids.
	Number.	Ratio per 1,000 Strength.	Number.	Ratio per 1,000 Strength.	
Below 20	9	4·59	26	25·49	31·82
20 to 24	202	9·33	576		
25 to 29	163	7·88	668	32·28	35·31
30 to 34	98	10·93	348	38·82	18·39
35 to 39	46	11·18	220	56·72	14·48
40 and upwards	8		54		
Total	526	—	1,892	—	100·0

* Excluding cholera and deaths from violence.

The ratios in the last column depend on the strength at each group of ages. But the ratios per 1,000 of deaths and invalids appear to show what what may be called the most economical army for Indian service, if it were attainable, would be one with ages at 25. Younger ages are unprofitable on account of losses from deaths and invaliding, as are also the higher ages.

15. We shall next show briefly the relation of mortality from the more important death causes to age and period of service, beginning with enteric fever.

Ages.	Under 20.	20 to 24.	25 to 29.	30 to 34.	35 to 39.	40 and upwards.
Strength.	1,961.	21,653.	20,696.	8,964.	4,052.	779.
Enteric fever deaths	6	95	32	7	4	1
Deaths per 1,000	3	4·5	1·55	0·78	1·64	
Ratio per cent. of total	56·18		20·19	10·14	13·52	

In the preceding abstract it has been shown that there were nine deaths among men under 20 years of age, and we now learn that six of these deaths were due to enteric fever. Of ages under 25 there were 211 deaths, and the preceding table shows that 102 of these were due to enteric fever. In the course of the year 1882 there were altogether 146 deaths from enteric fever in the Indian European army, and 102, or nearly 70 per cent. of them took place at ages under 25. Taking the strength at the same ages into account, the table shows that, assuming the whole liability to death from enteric fever as represented by 100, no less than 56·18 per cent. of this liability falls on the men under 25 years of age.

16. Length of service in India has also a very important bearing on liability to death from this fatal disease. Young soldiers have necessarily short periods of service, and out of 19,237 who were in their first and second years in India, there were 89 deaths from enteric fever, or nearly 62 per cent. of the mortality. The next group of service years, the third to the sixth years, yielded 50 enteric fever deaths from among 25,876 men. So that the entire enteric fever mortality of 1882, with the exception of six deaths, took place among men in their first six years of Indian service. Hence, young ages and consequent short residence in India together form the main predisposing cause of enteric fever.

17. The same law of predisposition holds good as regards the whole tribe of fevers, as will be seen from the next abstracts.

Ages.	Total Fever Deaths.		
	Enteric Fever.	Other Fevers.	All Fevers.
Under 20	6	—	6
20 to 24	96	22	118
25 to 29	32	13	45
30 to 34	7	4	11
35 to 39	4	—	4
40 and above	1	—	1
Total	146	39	189

We thus learn that enteric fever causes nearly 80 per cent. of the total fever mortality, and that while nearly 70 per cent. of the total enteric fever mortality took place under 25 years of age, the same young ages yielded 67 per 100 of the total fever mortality. The liability according to years of service for non-enteric fever deaths follows a similar rule as we have shown in the case of enteric fever. Of 39 deaths from non-enteric fevers 14 took place in the first and second years, and 20 between the third and sixth years of Indian residence.

18. But these facts regarding the liability of young soldiers to deaths from fever form only one instance of an almost universal fact. For example, the statistics of 1882 show that of 587 deaths from disease (excluding all other deaths) 237 took place at ages under 25, and 233 in the first and second years of service. Of these latter, 104 were due to fevers, 14 to apoplexy and sunstroke, 7 to dysentery and diarrhœa, 25 to hepatitis, and 12 to phthisis pulmonalis. But still the most important death causes belong to the fever group.

It is unnecessary to pursue the subject further as the facts are well known, as are also their practical lessons, which are, that one important step in lowering the Indian army mortality, and increasing army efficiency, would be to send older men on service, and that until this change in ages can be effected every care should be taken to protect the health of young soldiers by completing drill before landing in India, making use of Hill stations, and attending to the sanitary improvement of all stations.

19. If any additional evidence were wanting to sustain the last recommendation, it is afforded by the experience of 1882 in the relative prevalence of enteric fever at Indian stations, of which 103, including depôts, are given in the year's statistics. Of these stations 54 escaped enteric fever. Twenty stations yielded one death each. Eleven had two deaths each. Eight had three deaths each. Three yielded each four deaths, two six deaths, one seven, and one eight deaths. The stations which suffered most were Cawnpore, 12 deaths, Lucknow, 13 deaths, and Sitapur, 16 deaths, the last out of a strength of 344 men. Whatever importance may be attached to the predisposing influence of young ages and early service, these figures are quite sufficient to show that there must have been local or special climatic causes to act on this susceptibility.

20. The effect of season and climate on Bengal fevers is shown in the following abstract, in which the admissions from enteric fever during a period of 13 years are contrasted with the admissions from other fevers for 1882 at the same stations. Hitherto the annual admissions from enteric fever have been too few to enable a comparison of this kind to be made, although it has an important bearing on questions of etiology.

Months.	Total Fever Admissions.		Months.	Total Fever Admissions.	
	Enteric Fever, 1870–82.	Other Fevers, 1882.		Enteric Fever, 1870–82.	Other Fevers, 1882.
January	104	1,158	July	133	1,542
February	83	705	August	178	2,927
March	135	917	September	239	2,893
April	255	1,230	October	159	3,629
May	356	2,140	November	120	2,634
June	230	1,743	December	116	1,689

It would appear from these figures that there is a corresponding progression in both fever classes up to the months of July and August. The month of maximum fever admissions is September, in the latter half of the year, for enteric fever, but at this time the drying-up season increases general fever admissions, whilst those from enteric fever began to decline.

There is, nevertheless, a certain correspondence in the figures which may throw some light on such points as the following, stated by the Sanitary Commissioner:—"Several medical officers refer to the "difficulties attending the differential diagnosis of enteric fever from other fevers of a continuous "nature, presumably malarious, and remark an extreme want of definition in the collective symptoms "of enteric fever, as rendering the separation of a case of this fever from the numerous other cases "of so-called simple, continued, or remittent fevers, extremely difficult."

The medical officer who had charge during the enteric fever outbreak writes that "in every fatal "case (of fever generally) there has been a *post-mortem* examination. In some the characteristic "intestinal lesion, not suspected during life, has been brought to light, and in others, when it has "been suspected, it has been absent. The chief difficulties in determining some of the cases of "enteric fever have been the high temperature on admission, afterwards becoming remittent, the "sudden seizure, and absence of rose spots, diarrhœa, and abdominal symptoms, and the occurrence "at the same time of malarious fevers amongst men of the same regiment." Of 18 cases at Cawnpore 11 were fatal. Ten cases came out of one barrack block, No. 2, all but one from the upper story.

The duration of fatal cases was from 10 to 110 days, and of cases which recovered from 48 to 132 days. Of 31 cases at Lucknow, diarrhœa was present in 24, rose spots in 21, and abdominal tenderness in 6. The medical officer at Saugor states that in six cases of undoubted enteric fever he had utterly failed to trace the cause of any of them to filth or fæcal contamination. He considers that the term "typho-malarial," would describe the fever better than the term "enteric."

21. If we place together the data for the three stations which yielded the largest number of enteric fever deaths in 1882, viz., Lucknow, Cawnpore, and Sitapur, we shall have an aggregate strength of 3,604. The fever admissions from among this number, and excluding those from enteric fever, were 1,212, or 336 per 1,000. The fever deaths were as follow :—

	Enteric Fever.	Other Fever.
Lucknow	18	1
Sitapur	16	—
Cawnpore	12	3

We have here two important comparisons; first, a low average per-centage of malarial fever attacks; and second, three severe outbreaks of enteric fever, the aggregate death-rate from which was tenfold the death-rate of non-enteric fever. But, nevertheless, the preceding monthly abstract of fever admissions shows that fevers of purely malarial origin prevail very greatly over those from diagnosed enteric fever, and this being the case it need excite no surprise that the real nature of this fatal fever may be masked in some cases by its malarial accompaniments.

It seems scarcely possible to resist the conclusion that enteric fever is another and far more fatal disease than any of the fevers attributable to malaria, although in many cases it may not be possible to complete the diagnosis until after death. We have already seen that this fatal fever is most prevalent among troops at the younger ages, and it follows that if the youngest ages were eliminated the fever mortality would at once fall. Remove the enteric fever element, and the death-rate from ordinary climatic fevers would be of comparatively little importance.

22. But at this point we are met by another question which must be answered, and it is the one already alluded to. If we admit to the fullest the influence of youth in predisposing to fever attacks, how does it happpen that if this be the only influence to be considered the proportion of fatal enteric fever differs so greatly at different stations and in different years in the same districts. There must be causes for the difference. The most likely cause is undrained foul subsoil, and possibly impure water at the stations themselves, and generally bad sanitary condition in neighbouring towns and villages. In dealing practically with problems of this class, it must be borne in mind that Indian experience has hitherto furnished no direct evidence of the specific character of enteric fever, and that past experience rather goes to show that enteric fever etiology is of complex character, and that the attack is the result of several concurrent conditions, of which general liability to malarial fever, young ages, and recent arrival in the country are among the more important. And that the proper work of the sanitary improver is to banish from all stations the whole tribe of local causes which are known from experience everywhere to lower the standard of health, and to predispose to epidemic diseases.

23. The next abstract table gives the death-rates for a series of years from the more important diseases not included in the preceding remarks.

Years.	Deaths per 1,000, Army of India.				
	Dysentery.	Diarrhœa.	Apoplexy.	Hepatitis.	Respiratory Disease.
1870–79	1·48	0·12	1·52	2·19	0·97
1880	2·96	1·34	2·69	1·34	2·93
1881	1·72	0·32	1·48	1·60	1·76
1882	0·57	0·07	0·85	1·40	0·75

The data for years preceding 1870 are not sufficiently complete for use, and these figures include the death-rates among troops on service in one or two of the years, but taken as they stand they show decreasing death-rates from these diseases.

24. There is one tribe of diseases to which we have often directed attention, and which shows no tendency to decrease, namely, venereal diseases. Admissions under this head for the Indian army have been as follow:—

Years.	Venereal Admissions per 1,000.
1870-79	208
1880	250
1881	260
1882	265

The subject has been so frequently discussed that it is only necessary to give the figures as part of the year's disease history.

25. In concluding these remarks on the sanitary condition of the Indian-European army, it must be admitted that the facts abstracted from the Sanitary Commissioner's Report show a gratifying reduction in the death-rates from the more important diseases, except in the case of enteric fever. The nature of these reductions points to the effect of sanitary improvements at military stations, and to generally improved management. The causes of enteric fever, which is now the most important death cause in the army, are sufficiently known to point directly to the remedy, and this is sending an older army, fully drilled, on Indian service. We cannot alter the climatic and malarial causes at present. The only element over which we have control is the subject, the young soldier, and in dealing with him we should not only reduce the death-rate but the loss from invaliding, and this, as we have already shown, falls most heavily on the younger ages, which suffer most from anæmia and general debility, the main invaliding causes. In 1882, out of the total invalids, 17·33 per cent. had under two years of service, and between two and five years the proportion was 57·30 per cent.

26. The depressing influences attending the first introduction of troops to Indian service, many of whom, as we have seen, are too young, is shown by the following comparisons. The death-rate in the Indian army generally in 1882 was 12·03 per 1,000, while in newly-arrived regiments it was 16·45 per 1,000. In the army generally the enteric fever death-rate was 2·53 per 1,000, while in newly-arrived regiments it was 7·18 per 1,000. The rate for other fevers was ·60 per 1,000 for new regiments, against ·68 per 1,000 for the army as a whole, a fact which apparently indicates a tendency for fevers to assume the enteric character at once in recently-arrived regiments.

27. *Women and Children.*—There were 3,539 women and 6,208 children belonging to the European army in 1882. The numbers have been reduced to about a half since 1875. The death-rate among women was 19·78 per 1,000, against 25·89 per 1,000 in 1875. The children's death-rate had also fallen from 69·75 per 1,000 in 1875 to 50·26 per 1,000 in 1882. There were two deaths, or in the ratio of ·57 per 1,000, from enteric fever, and none among children. Another year's experience has thus told against the milk theory of this disease.

28. *Officers.*—The strength of officers was 1,497 British and 1,294 Indian. Among the former were 20 deaths (three from cholera and three from enteric and typhoid fever). The Indian strength lost one from cholera, but none from enteric fever.

29. *Native Army.*—The following summary of the vital statistics of native troops gives the leading facts for the year 1882. It has been taken from the Sanitary Commissioner's Report:—

Presidencies.	Deaths per 1,000, including Absentees.	Average Strength Present.	Ratio per 1,000.			
			Admission to Hospital.	Daily Sick.	Deaths from Cholera.	Deaths, all Causes.
Bengal	16·49	40,256	1,250	41	0·72	13·34
Madras	14·99	27,654	879	30	2·64	12·01
Bombay	13·41	28,772	1,067	36	0·46	12·16
Central India and Rajputana	20·58	5,119	697	23	0·39	9·96
Punjab Frontier Force	18·89	10,605	1,992	60	—	15·94
Hyderabad Contingent	4·47	2,061	630	21	0·29	3·12
India	14·76	114,894	1,219	37	1·92	12·24

The data for the whole of India in the last line may be compared as to death-rates with the previous five years as follows:—

Years.	Death-rates per 1,000.		
	Cholera.	Deaths, all Causes.	Mortality, including Absent Deaths.
1877	1·53	10·90	13·38
1878	2·06	18·04	21·02
1879	4·61	35·15	37·79
1880	0·53	39·22	41·12
1881	0·97	19·24	22·62
1882	1·02	12·24	14·76

It will be seen that the death-rate among native troops in 1882 was 14·76 per 1,000 against 12·07 per 1,000 among European troops, while the cholera death-rate among Europeans was 1·07 per 1,000, and 1·02 per 1,000 among native troops. Both facts show that the sanitary progress in British regiments has overtaken that in native corps in their own country.

30. A comparison between the chief admission and death rates of the two armies affords some instructive contrasts. Thus, the admissions from intermittent fever, which averaged 493·6 per 1,000 for European troops, were 543·3 per 1,000 among native troops. This difference is not singular, because it has been shown before that native troops in their own country suffer more from this fever than do Europeans. But it is otherwise with the more severe fever types. Enteric fever, for example, which occasioned an admission-rate of 6·2 per 1,000, and remittent and continued fevers a rate of 52·7 per 1,000 among European troops, yielded among native troops an enteric fever rate of ·2 per 1,000, and a remittent and continued fever rate of 10·2 per 1,000. So that the total fever rate was, for European troops 552·5 per 1,000, and for native troops 553·7; very nearly the same. The death-rate from all fevers among European troops (including 2·55 per 1,000 from enteric fever) was 3·23, or not far from double the fever mortality in the native army, which was 1·76 per 1,000 (including 0·12 per 1,000 from enteric fever). The highest death-rate assigned to any single cause among European troops was the enteric fever rate of 2·55 per 1,000, but the highest assigned death-rate in the native army was 4·07 per 1,000 from respiratory diseases, which gave rise to a death-rate of ·75 per 1,000 in the European army. Diseases classed under this head are far more fatal among native troops, as is shown by the fact that 6·83 per cent. of the admissions proved fatal, against 1·01 per cent. among European troops. Deaths from dysentery averaged ·57 for Europeans and ·61 per 1,000 for natives, while from hepatitis the death-rate among the former was 1·40 and among the latter ·16 per 1,000.

The most remarkable contrast in admission-rates is afforded by venereal diseases, which amounted among European troops to 265·2 per 1,000 and among natives to 34·4 per 1,000.

Speaking generally, the statistics of the native army show improvement, but the classes of disease from which the admission and death-rates proceed appear to show defective stamina, probably arising from voluntary underfeeding, and in the case of respiratory diseases, the influence of climate extremes or, possibly, of want of conformity between the clothing and shelter and the climatic changes in different military divisions.

For example, the native army death-rate from respiratory diseases in Madras army was 1·16 per 1,000, while in the colder and more variable climates of the Punjab the death-rate was 5·94 per 1,000. The practical question suggested by these ratios is whether the climatic variations of the Punjab could not be met by local and special attention to clothing and housing of native troops.

31. As regards fevers and general sanitary conditions relating to their prevalence, the report under review contains much valuable information in the form of tabular abstracts of returns sent in from above 120 stations scattered all over India. At many of these stations there are European as well as native troops, and although the native huts and their surroundings have no parallel in the European barracks, nevertheless, where both armies are exposed to the same prevailing climatic and local conditions, we should naturally expect that both Europeans and natives would exhibit the influence of these conditions on the amounts of fever.

In so far as concerns native huts, nothing could well be more conducive to outbreak of epidemic diseases than the account given of the hutting at many stations. The huts' floors are generally close to or even under the ground level outside, without drainage, damp, defectively ventilated, and often overcrowded; but if the following entry, relating to Dharwar, applies to the recently constructed and improved lines we shall have an illustration before long as to how good barrack huts may be converted into bad ones. The report says, "Water and other sullage often saturates the ground in the vicinity of the huts." Someone should be held responsible for misfeasance such as this, whereby the expenditure of money and the object of it are both in the way of being lost from sheer carelessness. In many cases defective conservancy, domestic cesspits, damp or wet compounds, and sodden grounds are cited. The facts have been long known, and all we can do is to call attention to them as they are cited in the tables. To say the least of it, no such complaints ought to have been forthcoming at this time of day.

On the general malarial surroundings of many native stations, the information is explicit, and among such are cited marshes and marshy ground, river overflow, want of drainage, and the like, all of which necessarily form important elements in sanitary condition for European as well as native troops at the same stations.

The admission and death rates among native regiments differ as greatly as they do among Europeans. The lowest death-rate of the year was 1·95 per 1,000, at Saugor. A number of stations returned rates under 10 per 1,000, and from thence to 20, 30, and 40 per 1,000. Poona and Bombay returned a rate of 56·34 per 1,000 for the body guard, but the highest rate of the year was 78·15 per 1,000, among the 25th Native Infantry at Vellore and Bellary. The facts speak for themselves, and show the need of constant sanitary work and oversight.

32. *Jails.*—The jail population of all India averaged 94,063 in 1882. The admissions to hospital were 1,214 per 1,000, the daily sick 42·1 per 1,000, and the annual deaths 39·96 per 1,000, of which amount 15·21 per 1,000 was due to dysentery and diarrhœa, and 2·75 to cholera. During the five

years 1872 to 1876 the death-rate from all causes was 36·24 per 1,000, of which 13·48 was due to dysentery and diarrhœa and 2·86 to cholera. During the succeeding five years 1877 to 1881 famine intervened, which led to an augmentation of the prison population from 99,758 to 112,670, and on account of this large addition to the prison population of persons, many of whom had already suffered from insufficient food, the mortality rose to 63·01 per 1,000, of which 4·48 per 1,000 was from cholera and 24·97 per 1,000 from dysentery and diarrhœa. Taking these prisons as a whole, the statistics show that mortality has increased *pari passu* with the increase of prison population, which is an index to overcrowding, and also to the prevalence not so much of crime as of want leading to thefts. It follows, therefore, as a legitimate inference from the facts as stated by the Lieutenant-Governor of Bengal, that there is a direct connexion between the sanitary condition of prisoners in Bengal at least and the state of health among the general population from among whom they come. Given a population suffering from epidemics as the population of Bengal has suffered; subject a part of these, and this not the best part, to the restrictions and crowding of prisons, and there need be no wonder that prison mortality mounts up to 3, 4, 5, and 6 per cent. and upwards.

The chief admission causes in all the presidencies are fever, dysentery and diarrhœa, chest diseases, including phthisis pulmonalis and ulcers. The chief death causes are diarrhœa and dysentery, respiratory diseases, and phthisis. The average death-rate from anæmia and debility is 2·87 per 1,000. The death-rate from cholera varies greatly in the jails of different districts and appears to depend on the prevalence of cholera as an epidemic outside the jails. Death-rates in individual jails present a number of very startling facts, and which cannot be explained on the supposition that these rates are due to the unhealthy state of the outside population. For example, the jails in Bengal Presidency had an average death-rate in 1882 of 42·56 per 1,000, which in all probability does not greatly exceed the death-rate of the presidency as a whole. One of the jails (Fatehgarh Central) out of a jail population of 1,079 yielded a death-rate of 4·63 per 1,000, and had no deaths from cholera. From this minimum rate the death-rates mount up rapidly until they culminate in such rates as 205·56 per 1,000, of which 1·39 only was due to cholera among the 720 inmates of Raipur jail, and the maximum jail rate of the year took place in Mymensingh jail, of which the inmates yielded the enormous rate of 253·01 per 1,000 out of 415 prisoners. In this case the cholera death-rate was 40·96 per 1,000, but even deducting this from the total the rate was 212·05 per 1,000.

33. It is impossible to read the tables from which these figures are taken and not to recognise that they represent local destruction of human life within the jail limits, for it is absolutely certain that no such rates exist outside these limits. A few years ago it was supposed that a change in the diet scales had produced higher death-rates, but this view is disposed of by the statistics, which show that under more or less uniform scales the rates vary enormously. Of course, jail dietaries must bear a very decided relation to the amount and character of jail work, and this work itself must as a matter of ordinary administration be conducted so as not to destroy health and life, but the most probable acting cause of the mischief is the state of the jail itself, in its subsoil, buildings, drainage, water-supply, and means of disposal of sewage. In the Mymensingh case there is this note,—"The cause of sickness and mortality appears to lie in the soil," which, translated into sanitary language, means that the soil has been used up, just in the same way as the soil of a camp gets used up. The camp is removed and the sickness disappears, while on these undrained used-up jail sites, the jail and its inmates remain, and with what result is shown by the death-rates. In the Raipur example the report states that the prisoners included "a wild race," who were received from a jail where they had been overcrowded and otherwise subjected to weather and privations on the march. Nine of them had to be released on medical grounds.

34. The jail tables include brief notes on 246 jails in all parts of India. The most frequent cause of complaint appears to be overcrowding, defective ventilation, and insufficient drainage. But there is no doubt that unhealthy conditions of subsoil must be added to these defects.

It is not satisfactory to find that while the sanitary condition of stations of European and native troops has been improved with results already stated, these great jail establishments are much in the same state as they have been in times past. So far as relates to local sanitary questions as distinct from those of administration, the case may be included in the following proposition:—Given an enclosed population on a site which has been long used without shifting it, and without any provision by subsoil drainage for cleansing and drying it; let the buildings be imperfectly ventilated, subject to varying temperature, and the inmates occasionally overcrowded, let the water be of doubtful character, and the jail sewage imperfectly disposed of, and there are present the elements of high sick and death rates, and of occasional epidemic outbreaks.

35. *Vital statistics of the general population.*—The following table given in the report under review contains the corrected census data of 1881 for the whole of India. It differs in some details from the figures formerly published, and it contains other points of importance to public health questions, the fundamental data for which it gives for the first time complete:—

Province or State.	Area in Square Miles.	No. of Towns and Villages.	Population.			No. of Persons per Square Mile.	No. of Towns and Villages per 100 Miles.
			Males.	Females.	Total.		
Ajmere	2,711	739	248,844	211,878	460,722	170	27
Assam	46,341	22,408	2,503,703	2,377,723	4,881,426	105	48
Bengal	193,198	264,765	34,625,591	34,911,270	69,536,861	360	137
Berar	17,711	5,585	1,380,492	1,292,181	2,672,673	151	32
Bombay :—							
British territory	124,122	24,598	8,497,718	7,956,696	16,454,414	133	20
Feudatory States	73,753	13,191	3,572,355	3,368,894	6,941,249	94	18
Burma	87,720	15,857	1,991,005	1,745,766	3,736,771	43	18
Central Provinces :—							
British territory	84,455	34,612	4,959,435	4,819,356	9,838,791	117	41
Feudatory States	28,834	11,242	867,687	842,033	1,709,720	59	39
Coorg	1,583	503	100,439	77,863	178,302	113	32
Madras	141,001	52,648	15,421,043	15,749,588	31,170,631	221	37
N.-W. Provinces :—							
British territory	106,111	105,421	22,312,556	21,795,313	44,107,869	416	99
Feudatory States	5,125	3,322	384,699	357,051	741,750	145	65
Punjab :—							
British territory	106,632	34,324	10,210,053	8,640,384	18,850,437	177	32
Feudatory States	35,817	18,546	2,112,303	1,749,380	3,861,683	108	52
Baroda	8,570	3,012	1,139,512	1,045,493	2,185,005	255	35
Central India	75,079	31,506	4,882,823	4,379,084	9,261,907	123	42
Cochin	1,361	655	301,815	298,463	600,278	441	48
Hyderabad	71,771	20,398	5,002,137	4,843,475	9,845,594	137	28
Mysore	24,723	17,655	2,085,842	2,100,346	4,186,188	169	71
Rajputana	129,750	30,001	5,544,665	4,723,727	10,268,392	79	23
Travancore	6,730	3,719	1,197,134	1,204,024	2,401,158	257	55
Total	1,372,588	714,707	129,941,851	123,949,970	253,891,821	185	52

We now know that the population of all India, British and native, consists of 253,891,821, living in 714,707 towns and villages, scattered over 1,372,888 square miles of surface, at the rate of 185 persons per square mile: this average ratio including 43 per square mile in Burma at one end of the scale to 360 per square mile in Bengal at the other; and that the population groups are distributed between 18 per 100 square miles in Burma and 137 per 100 square miles in Bengal.

36. No data could show more clearly the greatness of the work of sanitary improvement which must be carried out sooner or later in India, and nothing can show more certainly its urgent necessity than the next set of data which give the disease history of this vast population.

The data, however, only refer to that part of the population which furnished death statistics in 1882, and this numbered 193,341,860, of which 11,780,046 were in towns and 186,561,814 in villages, a fact which proves that the real sanitary work in India has to be done among the country population. The registered deaths in 1882 under the customary headings were as follow:—

Cholera	347,932
Small-pox	85,131
Fevers	3,125,366
Bowel complaints	280,016
Injuries	74,041
All other causes	831,361
Total registered deaths	4,743,847

These figures give a death-rate from all causes, taken over the whole registering population of India, of 23·9 per 1,000, no doubt largely under the true rate.

37. In our memoranda on the sanitary reports of the different provinces, we have discussed the death causes under each of these heads, and we shall merely give the general results of the year's experience, beginning with cholera. This epidemic disease showed itself all over India, except in Mysore and Coorg, in January 1882, and every province suffered in the course of the year. The highest death-rate took place in Assam, where it reached 4·69 per 1,000. The lowest rate was 0·002 in the Punjab, where there were only 39 deaths from cholera. The monthly deaths for the whole of India were as follow:—

Months.	Cholera Deaths.	Months.	Cholera Deaths.
January	23,220	July	37,162
February	15,711	August	37,587
March	22,019	September	22,879
April	40,832	October	23,490
May	42,677	November	17,901
June	40,340	December	24,714

These figures, however, have no value for practical sanitary purposes. They merely show the aggregate monthly incidence of cholera, but the importance of such data depends on topography, climate, and local sanitary condition. As a matter of fact, cholera was generally diffused over India, but its severity differed greatly in different regions. The endemic area in Lower Bengal suffered most severely. The North-West Provinces, the Central Provinces, part of Bombay, and the southern portions of Madras Presidency yielded most of the deaths.

38. The following tabular abstract shows how the epidemic was distributed in 1882:—

Provinces.	Registration Circles.		Population Groups.		Cholera Deaths per 1,000 of Population.
	Total Number.	Returning Cholera Deaths.	Total Number.	Attacked by Cholera.	
Bengal	641	609	201,989	27,314	2·75
Assam	686	314	18,701	3,082	4·69
North-West Provinces and Oudh	1,143	668	105,421	10,838	2·09
Punjab	446	28	34,573	30	0·002
Central Provinces	168	101	27,529	1,605	1·36
Berar	133	111	5,988	481	1·40
British Burma	350	148	14,942	232	1·96
Madras	226	145	47,825	3,264	0·80
Bombay	286	120	24,481	804	0·48
Total	4,579	2,244	480,549	47,648	1·75

These data, which represent the distribution of cholera over the whole of India in 1882, are obtained solely from the registering population, but they may be taken as pointing out the law of distribution. We learn from them that out of 4,579 registration areas, covering the whole country, cholera showed itself in 2,244 only, and it follows that something was present to occasion death in these 2,244 circles which was not present in the remaining 2,335, although the areas which suffered and those which did not suffer were scattered indiscriminately over the whole surface of the peninsula. Now, it is quite clear that no etiology of cholera which does not include these striking facts of partial distribution of this disease can be accepted for practical purposes. Why the epidemic should wander over the country in this way among people living under precisely the same health conditions, and should fall like a deadly shower on certain areas and not on other areas close to them, involves a question to which at present there is no reply, and no single assumed cause can help us to an answer.

39. The facts in regard to population groups are even more remarkable. In every registration circle the population is aggregated into village and town groups, which number in all the circles 480,549, and the preceding table shows that the entire registered cholera mortality of 1882 was yielded by 47,648 of these groups, or less than a tenth part of the whole. One village is attacked and its neighbours escape. There is no spreading from a centre anywhere. The attacks are independent of each other. It would appear as if the epidemic rain, so to speak, which visits attacked circles, really consists of separate showers falling on parts only of the circle area and leaving the others intact. Every year's experience helps to confirm the view long since put forth by the late Dr. Bryden, after a careful study of the whole subject, that cholera is air-borne, and that its distribution is determined by air currents, by season, and by local topography. This view, moreover, solves important difficulties in epidemic history, because, according to it, just as cholera passes over the limited area of a registration circle to fall beyond it, so it may pass over land and sea, leaving no trace of its progress until, from some unknown factor, it swoops down in places hundreds of miles away from where it was last heard of. In this way it appears to have reached Zanzibar, Aden, Arabia, Central Asia, after passing over gigantic mountain chains, and we know that, in the year 1860, it suddenly appeared at Gibraltar at a time when there was no cholera nearer than the Punjab. Was not the late fatal outbreak in Egypt one of these epidemic phenomena? and the sudden descent of cholera on the south coast of France in the present year another? In the same way, when cholera attacked Malta in 1865 it appeared far inland in Algeria, many hundred miles away.

40. But the great practical point brought out in all the reports of provinces, ever since they were published, many years ago, is that, whenever cholera falls on a village, it selects its resting place where the people live in neglect of healthy conditions and civilized habits. Wherever sewage of men and animals is permitted to mingle its foul emanations with the air to be breathed, or its filth and foul drainage with the water for domestic use, there cholera will come, not in all such places in the same year, otherwise India would soon be depopulated. Population groups are left untouched, almost as if to have another opportunity of profiting by the sufferings of their neighbours, but certainly to suffer loss in due time if the warning is neglected. Attacks and exemptions similar to those which are of constant occurrence among the civil population have been observed at stations of European troops. Thus, in 1882, there were 374 buildings occupied by troops at stations where cholera appeared, but the cases were confined to 64 buildings, or 17·1 per cent. of the total.

41. The Sanitary Commissioner has continued down to 1882 the experience derived from cholera hospitals, to show the liability of attendants on the sick to attacks of the epidemic, with the following results:—

Cholera cases treated, 1877 to 1882, 4,999.
Number of attendants, 9,190.
Attendants attacked, 170, or 1·8 per cent.

Whatever may have been the effect of proximity to cholera cases on this per-centage of attacks, it is certain that they took place in localities where cholera had appeared, and were subject to the usual law of locality; for wherever cholera appears a locality has been already prepared, and the only way of escape is not to stay there as these attendants were obliged to do, but to go away as the European troops did, and the Sanitary Commissioner informs us "that the effect of the movement of affected troops and prisoners was beneficial in all cases."

In the course of the year 1882 the liability of attendants on cholera cases was as follows:—

(*a.*)	Hospitals in which cholera cases were received	105
	Cholera cases treated	645
	Number of attendants	1,331
	Attendants attacked by cholera	21

(*b.*) But so stated the facts do not convey a true idea of what actually occurred, which was as follows:—

	Hospitals where attendants escaped cholera	88
	Cholera cases treated there	431
	Number of attendants	1,010
(*c.*)	Hospitals where attendants were attacked	17
	Cholera cases treated	214
	Number of attendants	321
	Attendants attacked	21

It may be further stated that, of the 21 attacked attendants, two were attached to marching regiments who passed through cholera districts, two to hospitals of European troops, three to hospitals of native troops, and the remaining 14 were on service in jails, and were exposed to jail conditions already described.

This part of the case may be summed up in a few words as follows:—When cholera appears among a group of persons in any locality, it is a clear proof that the disease is about to become localised, and the only course to follow is to leave it for a time; it is never safe to enter an insanitary place where cholera is present, but, of course, in instances where localising causes have been diminished as they are in properly appointed cholera hospitals there will be little to fear from cholera, as these statistics prove, even in cholera localities.

42. *Small-pox and Vaccination.*—The total deaths from small-pox in 1882 amounted for all India to 85,131. The lowest district death-rate was 0·1 per 1,000 in Berar; the highest, 2·61 per 1,000, was registered in Coorg.

The special vaccination staff for the whole of India stood as follows:—

Sanitary Commissioners	9
Deputy Commissioners	14
Superintendents	53
Deputy Superintendents	23
Native Superintendents	222
Average of vaccinators	3,502
Total special establishment	3,823

But a considerable amount of vaccination work is done by the dispensaries. The successful vaccinations performed by both agencies amounted to 4,329,419, but a very important question arises at this point, namely, the relation of vaccinations to ages and to births. The total births are only matters of estimate, and the estimated number, 7,345,388, is perhaps above the truth, but it may be compared to a certain extent with the successful vaccinations given above. The data regarding ages of vaccination are more reliable, and were as follow:—

Vaccinations under one year	1,614,149
,, one year and under six	2,085,379

It will be observed that the vaccination work requires great extension during the first year after birth before it can overtake the births, and this is the direction in which vaccination is calculated to do most good. The cost of each successful case varied from 1a. 6¼p. in Bengal to 8a. 5p. in British Burma.

43. *Fevers.*—As already has been shown, fever is a far more important disease and death cause than all other assigned causes. Out of every 47 deaths throughout India, 31 were registered under this head in 1882. It prevailed in every district during the whole year, and probably every

population group yielded either fever cases or fever deaths or both. Its monthly incidence for all India stood as follows:—

Months.	Fever Deaths.	Months.	Fever Deaths.
January - -	271,920	July - -	225,180
February - -	216,927	August - -	258,228
March - -	227,405	September - -	287,769
April - -	217,788	October - -	312,091
May - -	237,620	November - -	327,675
June - -	215,490	December - -	327,323

This abstract shows the operation of general climatic laws all over India. The period of highest fever mortality is the time of evaporation after the year's rain, attended by low and variable temperature. But the local fever causes determine the local prevalence of fever under the general climatic law. Want of drainage, wet or damp locality, irrigation, without drainage, bad housing and unwholesome domestic habits are all intensified in their effect on health by the climate. Fever causes are climatic and local. We cannot control the former, but we can remove or mitigate the latter, and it is in this direction alone that we can cope with Indian fevers.

44. Deaths from *Bowel complaints* require no special notice in this general account, unless it be that the following figures show that climate also influences their number:—

Month.	Bowel Complaint Deaths.	Months.	Bowel Complaint Deaths.
January - -	20,561	July - -	25,743
February - -	17,571	August - -	32,811
March - -	17,797	September - -	30,766
April - -	18,643	October - -	27,209
May - -	21,564	November - -	24,885
June - -	20,488	December - -	23,032

Diseases classed under this head are chiefly diarrhœa and dysentery, the prevalence of which is to some extent determined by local insanitary conditions, but the monthly table appears to show that the mortality is influenced by hot moist rainy weather.

45. *Injuries.*—Out of 74,041 deaths registered under this head 8,342 were suicides, 5,094 were from wounding, 37,690 from accidents, and no fewer than 22,915 from snake bite and wild beasts. In Bengal alone 45·7 per cent. of all violent deaths were due to these latter causes. The number is very small when compared with the vast totals of preventible deaths shown above, but still better results ought to be obtained.

46. *All other causes.*—The only remark called for under this head is that it included 831,361 deaths, of which, in the present state of registration, no account can be given.

47. *Bengal Sanitary Works (Military).*—The total outlay on military works and barracks in 1882 was 531,057*l.* Of this amount 200,985*l.* was spent on repairs, and 160,119*l.* on "original works." At Lucknow, 28 half-company barracks had been completed or approached completion.

A rest barrack for troops had been built at Saharanpur, married quarters at Pachmari, and some subsidiary accommodation for artillery at Umballa. At this station the water-supply is being extended. The Peshawur water-supply has been partially completed and distribution works carried out. Water-supply for Cherat has been completed, as has also been the drainage of Lucknow, but no account is given of the nature of drainage works in a great city at a cost of 1,538*l.* Chakrata water-supply had been improved. Besides these works a number of others were under consideration.

All this is good as far as it goes, but the enumeration is followed by abstracts of reports from 66 cantonments of British troops in Bengal Presidency, in which are stated not only the prevailing diseases, but the presumed local causes. The prevailing diseases at most of them are fevers of various types, including enteric fever, and the local causes are those which are quite well known to be associated with these fever types, and which are mainly connected with foul water-logged subsoil conditions called into greater activity by climatic causes. The abstracts are so tersely given that we should have to copy them entire in order to give a suitable account of fever causes. This would be out of place, but we can in the strongest manner call the attention of the authorities to these statements, and express our opinion that blame rests somewhere; that Her Majesty's troops have had their health and efficiency injured for want of well known sanitary improvements which it must have been someone's duty to see executed, because we cannot suppose that after all these years of sanitary inspecting and reporting the facts have been unknown.

48. Under the head of *Civil Sanitary Works* is given a brief digest of works carried out or in progress by municipalities in the various Governments. It is not necessary to reproduce the details as they will be found in substance in our memoranda on the reports.

49. The last section of the report, section X., is devoted to the discussion of several subsidiary matters, and amongst others to the question of quarantine in Egypt against Indian ships, and the relation of cholera in Egypt in 1883 to cholera in India.

We have already stated our views on the movement of cholera as deduced from the complete statistical history of the disease worked out by Indian statisticians in past years, and it has been shown from the simple facts and dates that cholera moves in India, and away from it and out of it, without any reference to roads, railroads, ships, or any movements of population.

An epidemic is governed by its own laws, and the cases in which the disease has appeared in ships after leaving Indian ports, and other ports likewise, among persons who have come on board from epidemic localities, are no exception to the epidemic law. They cannot be rendered more intelligible by a resort to "germs," or "contagion," or any other occult cause, and the great question practically is whether there is evidence that cases of this class have ever generated epidemics in countries to which they have come? The answer is at hand, in the fact that there is no evidence of any importation of a cholera epidemic in this way, that epidemics of cholera have appeared without any such communications, and that attempts to arrest the disease by quarantine have totally failed. We may also state in passing that the real history of Indian cholera can only be obtained from the vast mass of statistics which exist to show what this history is. Anyone with knowledge of sanitary statistics can understand it, but unfortunately there are few who have the knowledge or opportunity of doing so, while every officer who comes in contact with a case of cholera, in the absence of knowledge of the great epidemic events taking place at a distance, not unnaturally builds up his own theory upon the few observations he has the opportunity of making, and so year after year the controversy goes on and sanitary progress in endangered, simply because the great mass of information which the Government of India has obtained is all but unknown.

Until these results of many years of observation and inquiry have been set aside, and others established in their place, quarantine can be based on no scientific data, and must be considered as a survival from beliefs popularly held about epidemics in the middle ages when no such data were attainable.

So far as regards Egypt we now know that the only wonder is that in its now quite detestable sanitary condition it is ever free from epidemics.

50. Appended to the report is a memorandum by Surgeon-Major Cuter on Indian Waters and Water Analysis, which contains much useful information on the whole subject, and some of his remarks may be quoted on account of their general applicability to the selection of water sources. He says, for instance:—"A person on the spot observing the site, surroundings, and construction of "all the water sources of a station, and making a single qualitative examination, where necessary, "can give more useful information in a sanitary point of view than could be obtained from an "elaborate chemical analysis of a few well waters. Where there are manifest defects in the conservancy, exposing the source to sewage pollution, or where the physical qualities of the water are "bad, a chemical analysis is a matter of supererogation till the source has been cleaned and "its conservancy improved."

Next, as to the natural qualities of waters:—"In the Himalayan stations the potable water consists "of what runs off the surface or percolates into the thin layers of débris covering the hill sides and "into the cracks and fissures of the more solid rocks, issuing at lower level as springs and streams. "In clean tracts occupied by forests or cattle pasture the water is very pure. It contains from 4 to "16 grains per gallon of total solids, with only traces of chlorides or nitrogenous material. The "chief salts are carbonate of lime, and traces of sodium, chloride, and sulphate. The organic matter "is almost entirely carbonaceous. In deep well waters much of this carbonaceous matter, derived "from the organic mould of the surface, has disappeared from chemical change. . . . . In "ground closely occupied by human habitations, as in our hill stations, the subsoil water is often a "kind of diluted sewage." The quality of tank water depends on careful use of the tanks, but the source is an objectionable one from the amount of sewage impurity. "The supply from wells is "usually of sufficiently good quality if they are sunk in a pure subsoil and are properly constructed "and conserved." The great Indo-Gangetic plain approaches the "condition of a basin as regards its underground drainage. It is about 1,200 miles long and on an average about 200 broad." It is composed of sheets of "sand and clay, and of mixtures of these to an unknown depth, and is formed of "the débris of the hills, brought down by the Himalayan rivers and lodged in the great Indo-Gangetic "depression." In the Tarai region there is sweet subsoil water at a depth of 10 or 20 feet. In the low ground of the valleys of the Khadar land the subsoil water derived from infiltration from rivers is found to present the character of filtered river water. There is a constant circulation of water which finds its way along the drainage slope as an underground stream accompanying the surface river. The amount of salts does not necessarily imply sewage pollution in many districts, because the soils are saline. "Nevertheless, in foul villages and old towns, they are good measures if compared with those in the surrounding purer area." The circulation of underground water is so slight that pure waters may be obtained close to polluted wells, showing the purely local nature of the sources of pollution.

The work of inspection and simple qualitative examination of waters can be done, Dr. Cuter thinks, by local medical men, or by inspecting officers. In our suggestions for the sanitary improvement of Indian stations and their vicinity (1882 edition) will be found practical methods of dealing with these Indian water-supply questions.

51. We cannot conclude these remarks without a word of approval for Dr. Stephen's valuable statistics of the European and native armies and jails of India, commenced by the late Dr. Bryden. This work must form the basis of all sanitary inquiry.

52. In conclusion, what then is the result of the sanitary experience in India up to the present time? On the facts contained in the report under review it may be safely answered that a very great reduction has taken place in the course of years in the death-rates of European troops at Indian stations, but that troops engaged in field warfare are still subject to higher death-rates than they ought to be.

The reductions have been chiefly in those death causes which were formerly connected with defective conservancy, bad water, and unhealthy barracks and hospitals, now removed or in the process of removal, and improved army administration must likewise be credited with part of the result. But the European army is still subject to excessive admission rates and high constantly-sick rates from disease causes connected with unwholesome subsoil, want of subsoil drainage, unhealthy bazaars and native towns, in the vicinity of stations and general district, malaria, proceeding from malaria, generating conditions of the vicinity of stations not yet remedied.

Sickness in native lines is mainly due to the same causes and to unhealthy hut construction.

The mortality in jails appears to be connected mainly with local causes affecting prisoners confined within jail boundaries.

There is no evidence to show that much reduction of the great epidemic fever mortality of the civil populations has yet been effected. Some of the towns can show good work done, and no doubt reduction of sick and death rates; but the town population is only a small part of the civil population, and the old disease and death causes may be expected to follow their usual course until the vast village population has been taken in hand by the authorities, and the long known disease causes removed.

53. The result of the whole is, that military stations and their vicinity should be continuously improved, especially in drainage of subsoils and removal of surface malarial causes, and that further efforts should be made to send older troops to India.

As matter of detail those stations which show the highest sick and death rates should be taken in hand at once. One of the chief uses of sanitary statistics is indeed to show where money may be most efficiently laid out.

When cholera threatens any station the best thing to do is to withdraw the troops at once, and before they have become influenced by local epidemic causes, to a locality where there is no cholera. The same rules apply to prisoners in jails. As regards the vast civil population, the experience of 1882 has confirmed that of previous years, that the epidemics by which this population is decimated are directly related to their unimproved sanitary condition. What the causes to be removed are have been long known, but they are still left to do their deadly work. The remedies are also known, but they are not applied.

Lastly, we would express our acknowledgments to Dr. Cuningham, who has fully exposed the existing evils, and we hope, before many years have elapsed, that the Sanitary Commissioners of all the Governments may be able to report progressive removal of them, and of corresponding improvement in the public health.

30th July 1884.

No. 2.

MEMORANDUM of the ARMY SANITARY COMMISSION on the REPORT of the SANITARY COMMISSIONER for MADRAS for 1882.

1. The population of Madras Presidency, furnishing returns of births and deaths in 1882, numbered 28,887,111 out of a total census population in 1881 of 30,839,181.

2. The registered births on the former number were 751,104, or 26·0 per 1,000, the largest proportion ever registered in the presidency, which may be compared with the lowest proportion of births, namely, 11·9 per 1,000 registered in 1878, the year succeeding the great famine. The great increase in registered births is probably due to passing away of prejudice against registering of births, as well as actual increase of infantile population. This, which is the opinion of the Sanitary Commissioner, affords the most likely account of the great apparent increase of births during recent years.

3. During 1882 there were registered 470,700 deaths, or 16·2 per 1,000 of the same registering population. This is the lowest rate registered, the highest having been reported during the famine year 1877, which was 53·2 per 1,000.

Birth and death rates are below the truth, especially the latter, and the 16·2 per 1,000 rate gives an imperfect idea of actual facts, as may be learned from a comparison of the district and town rates for 1882. The districts with a population of 27,388,812 yielded a death-rate of 15·9 per 1,000, against a previous five years' average of 20 per 1,000, while the towns, with a population of 1,498,299, returned a rate of 23·3 per 1,000, against a previous five years' rate of 26·5 per 1,000.

4. As we have done in the memoranda on other presidency reports, we shall here introduce the sanitary data for districts, premising that the population under registration is stated to be that of the census of 1881 :—

Districts.	Population.	Area in Square Miles.	Birth-rates, 1882.	Death-rates per 1,000.	
				1882.	5 Years, excluding 1877.
Ganjam	1,388,619	6,813	25·3	20·4	23·2
Vizagapatam	1,843,503	18,344	15·2	13·8	15·4
Godavari	1,592,103	6,224	21·6	16·9	23·7
Kistna	1,452,056	8,036	22·1	17·8	20·1
Nellore	1,376,483	8,462	19·4	10·1	14·7
Madras	381,926	27	43·2	34·8	38·9
Chingleput	934,523	2,753	41·5	20·6	20·6
South Arcot	1,755,324	4,878	25·6	14·7	18·3
Trichinopoly	1,199,155	3,515	29·8	18·8	20·0
Tanjore	1,972,320	3,654	31·3	23·6	24·3
Madura	2,266,274	9,502	28·6	15·3	16·9
Tinnevelly	1,693,629	5,176	28·1	18·2	20·5
Kurnool	914,283	7,359	28·0	15·5	30·6
Cuddapah	1,350,967	8,367	24·8	14·4	25·3
Bellary	942,912	11,007	24·1	15·9	27·1
Anantapur	752,903		24·0	12·7	
North Arcot	2,014,254	7,139	26·2	12·6	18·6
Salem	1,966,362	7,483	22·5	10·7	17·5
Coimbatore	1,762,679	7,432	23·9	14·3	13·2
Nilgiris	72,396	749	15·6	14·8	18·3
South Canara	918,042	3,902	27·8	17·2	22·9
Malabar	2,238,228	6,003	23·8	15·4	17·4
Total	30,749,401	138,318	26·0	16·2	20·4

This abstract shows the present state of registration in each district. In some districts the work is further advanced than in others, but if we except Madras district, in scarcely one of the others can the rates be accepted as showing the sanitary condition of the people.

5. The following were the registered death causes in 1882 :—

Diseases.	Total Deaths.	Deaths per 1,000.
Cholera	23,604	0·8
Small-pox	20,759	0·6
Fevers	188,561	6·5
Bowel complaints	19,958	0·6
Injuries	11,611	0·4
Other causes	206,807	7·1
All causes	470,700	16·2

This abstract shows that out of every 47 deaths not far from 21 were neither diagnosed nor classified. This is merely one of the incidents connected with the present imperfect state of the registration, and absolute want of knowledge is better than error in this case.

6. There is very little sanitary information in this year's report on the epidemic history of the year and its concomitants. We shall therefore confine our remarks mainly to any points requiring notice in the statistics of the chief diseases.

Cholera.—The following abstract gives the statistical history of this epidemic disease for the last 17 years :—

Years.	Deaths from Cholera.	Years.	Deaths from Cholera.
1866	200,961	1875	94,546
1867	38,205	1876	148,198
1868	8,063	1877	357,430
1869	21,034	1878	47,767
1870	55,867	1879	13,296
1871	17,656	1880	818
1872	13,247	1881	9,446
1873	840	1882	23,604
1874	313		

This table shows the end of a great epidemic in 1868; next, a four years' epidemic, ending in 1872, during the prevalence of which 107,804 people died of cholera. Next follow two quiescent years, and then a great epidemic lasting five years, and including the famine period, during which 660,632 deaths from cholera were registered. The following year, 1880, was one of quiescence, and the next two years, 1881–82, appear as if they formed the beginning of another epidemic.

7. The outbreak of 1882, with its 23,604 deaths, presents some points of interest. Cholera prevailed with great severity in the endemic area of Lower Bengal; but as this cholera showed no disposition to pass directly from the river deltas into the Central Provinces, so it passed over all the districts of the north-east of Madras, and did not appear in force in any of them until April. But in the meantime cholera had appeared in strength in Madras district and the regions of the presidency south of the latitude of the city in January, February, and March. The first two months of 1882 bore the weight of the epidemic in these regions, and it faded away towards the end of the year, with a slight tendency to increase after September. In the far north-eastern districts the maximum mortality was reached in June, and in the far south-western district of Malabar the highest death-rates took place in August and September.

This epidemic bore no mark of cholera invading Madras by way of the north-east. It appeared as if the disease had descended upon the attacked districts, as it apparently did on certain parts of Bombay. There was no continuity of surface attacked, and there were large areas of country which escaped, or nearly so. No deaths were reported from four districts. Out of 226 registration circles 145 were attacked, but the whole mortality of the year was furnished by 3,262 villages out of 47,325 in the presidency.

8. The next abstract shows the cholera deaths registered in each month of 1882:—

Months.	Cholera Deaths.	Months.	Cholera Deaths.
January	10,794	July	550
February	4,193	August	780
March	1,081	September	644
April	491	October	777
May	590	November	799
June	843	December	2,062

The cholera epidemic shown in the table did not, however, begin in January 1882. We must go back to the preceding year in order to arrive at the true history of the outbreak, which was as follows:—

During the first six months of 1881 there were 401 deaths from cholera in the presidency. The disease was not epidemic, and it ended in four deaths in July and one death in August. The true epidemic began with four deaths in September, followed by 297 in October, 1,323 in November, and 7,403 in December, and thence to the monthly deaths in 1882, shown in the table.

9. The comparative death-rates of town and country registration circles stood as follows:—There are 72 towns, with an aggregate population of 1,498,290, of which 45 registered 3,932 cholera deaths, equal to a death-rate of 2·6 per 1,000 taken over the whole town population. Twenty-seven towns escaped altogether, and in others the deaths were very few in number. In not a few towns, however, the outbreaks of cholera partook of a distinctly local character, and led to very high death-rates, such as 5, 7, or 9 per 1,000. One town in Malabar, Ponani, with a population of 17,453, had 161 deaths from cholera, a rate of 14 per 1,000. The highest cholera death-rate of the year was returned from Periyaculam, a town with 13,468 inhabitants, in Madura district, which lost 375 people from the epidemic, equal to a death-rate of 27·8 per 1,000. To show the local nature of these two severe outbreaks, it may be stated that the death-rate from cholera in Malabar district, within which the former town is situated, was 0·4 per 1,000, and the rate for Madura, within which was the latter, was 1·6 per 1,000.

In the rural circles, with a population of 27,388,812, there were 19,672 cholera deaths registered, or 0·7 per 1,000 of the population. As has been already stated, four districts escaped cholera altogether. In three others there were in all 18 deaths, so that the cholera epidemic of 1882 fell on the population of 15 districts out of 22, and of the attacked districts two yielded rates of 1 per 1,000, two of 1·1 per 1,000, one of 1·6, and one, Tanjore, of 4·3 per 1,000. This district has a population of 1,789,494, and lost 7,767 of them from cholera. Two of its towns had death-rates below the district average, but the other three exceeded it, and two of them more than doubled the district rate.

10. This class of facts points to the partial distribution of the epidemic, and to its much greater severity in certain circles of registration than in others. In other words, the distribution of cholera in affected regions was general, but its severity was local. And this involves the question of local predisposing causes during the prevalence of an epidemic, instances of which will be given in subsequent paragraphs.

11. *Small-pox.*—The following tabular statement gives the statistics of small-pox mortality in Madras Presidency for a period of 12 years:—

Years.	Deaths from Small-pox.	Deaths per 1,000 of Population.
1871	20,823	0·8
1872	39,074	1·2
1873	51,782	1·7
1874	48,343	1·5
1875	24,775	0·8
1876	23,469	0·8
1877	88,321	3·0
1878	56,360	1·9
1879	17,840	0·6
1880	14,529	0·5
1881	15,776	0·5
1882	20,159	0·6

This abstract shows a very general prevalence of small-pox in Madras Presidency, with periods of aggravation rather than of decline, and high death-rates in individual years, of which the famine years 1877–78 afford remarkable examples. Of the deaths in 1882 there were 4,713 under 1 year of age, 9,286 between 1 and 12 years, and 6,160 above 12 years. All the districts suffered in 1882, and small-pox deaths were registered in 212 circles out of 226. The number of attacked villages is not given, but 57 towns out of 72 suffered, some of them severely. The country circles yielded 17,907 deaths, or 0·6 per 1,000, while the towns registered 2,252 deaths, or 1·5 per 1,000. The highest district rate, 2·9 per 1,000, was returned from Ganjam, and all the 22 districts, with three exceptions, returned rates under 1 per 1,000. In the towns the rates were generally much higher than in the country circles, and one town, Coimbatore, yielded the very high rate of 10·7 per 1,000. This town has a municipal government. The births registered in Coimbatore in 1882 were 1,318. The successful vaccinations amounted to 1,644, of which 728 were under 1 year of age, or about half the births, and out of 378 small-pox deaths 119 were under 1 year of age.

12. The following five years' abstract shows the relation of vaccination work to births and to deaths from small-pox, but the births registered obviously do not include the numbers born:—

Years.	Registered Births.	Total Vaccinated.	Deaths from Small-pox.
1878	348,657	521,760	56,360
1879	477,762	469,744	17,840
1880	659,991	659,759	14,529
1881	731,866	601,222	15,776
1882	751,104	661,133	20,159
Total	2,969,380	2,913,618	124,664

According to these figures, the vaccination work has nearly averaged the registered births during five years, but the vaccinations appear to include re-vaccinations. The per-centages of successful operations have been for 1882, 92·8 for vaccinations, and 45·8 for re-vaccinations. The five years' average of successful operations has been 14·8 per 1,000 of the population, and the five years' average small-pox mortality has been 4·2 per 1,000. For the municipal towns the results from some cause or other have not been so favourable. Their vaccinations have averaged 38·5 per 1,000 of the population, and their small-pox deaths 2·5 per 1,000 for the same five years.

13. The vaccine establishment for 1882 was as follows:—

Inspector of vaccination and Deputy Sanitary Commissioner	1
Deputy Inspectors, 1st class	31
" " 2nd class	19
Vaccinators, 1st class	245
" 2nd class	375
Probationers	112
Peons	37

The total cost of vaccination service in 1882 was Rs. 1,65,456 15 10, and the cost of each successful case was As. 4 6.

14. The small-pox deaths registered in each month of 1882 gave the following results :—

Months.	Small-pox Deaths.	Months.	Small-pox Deaths.
January	1,668	July	1,446
February	1,819	August	1,598
March	2,180	September	1,380
April	1,905	October	1,585
May	1,662	November	1,540
June	1,449	December	1,987

These deaths were returned month by month from every district, except South Canara, which had no deaths in January, February, and March, and Nellore, which escaped in July, August, and September. Practically, the year's epidemic covered the entire surface of the presidency, and the figures in this abstract show that the epidemic was by no means at an end in December, but would pass on to 1883.

In a preceding table we have given the annual small-pox mortality for a series of years, and if we leave out the exceptional years of famine and scarcity, 1877–78, it will be seen that of recent years there has been a decline in the death-rates from this epidemic disease, probably due in part to vaccination, but it is evident that considerable advance is required in this protective measure, as well as in the general sanitary improvement of towns and villages. The two measures ought to go hand in hand.

15. *Fever.*—The relative importance of different epidemic diseases in Madras to the public interests is well put by the Sanitary Commissioner in the following paragraph of the present report :—

"If we total up the number of deaths returned under the head of fever for the past 14 years we "get the appalling number of 3,269,522, whilst cholera, which creates much more fear and alarm, "gives us only 787,684, and small-pox 464,124," and to this estimate of the far greater importance of fever must be added this other fact, that every death from fever represents from 20 to 30 attacks, with their consequent diminution of working power in the sufferers.

16. If fever diagnosis and death registration were alike trustworthy we should be compelled to admit a large increase in the annual fever deaths of late years. The Sanitary Commissioner gives a table which shows that the lowest fever death-rate in 17 years was registered in 1866, the first year in the series. From this year, with 110,102 fever deaths, the deaths went on increasing, and in 1872 they had reached 214,148. Their numbers since then have been as follow :—

Years.	Fever Deaths.	Years.	Fever Deaths.
1873	222,842	1878	374,448
1874	226,220	1879	285,477
1875	252,042	1880	209,940
1876	230,092	1881	203,542
1877	469,241	1882	188,561

The years 1877–78 had exceptionally high fever-rates due to the famine, but allowing for this event the record is a sorrowful one enough, and affords an index to the kind of improvements needed in local drainage of village sites, better dwellings, better water, and improved tillage.

17. In 1882 the whole presidency suffered from fever prevalence, which is shown by the fact that all the 226 registration circles, with one solitary exception, returned fever deaths. The number of attacked villages is not available, but it may be safely stated that few escaped the disease. All the 72 towns returned fever deaths. Their average fever death-rate was 5·4 per 1,000, while the district rate averaged 6·5 per 1,000, which was also the general fever death-rate for the whole presidency. This was, however, lower than the previous five years' average, which was 9 per 1,000.

18. Fever mortality varied greatly in different districts. In Tanjore, for instance, it was only 1·7 per 1,000, with a previous five years' average of 2·5 per 1·000, while in Kurnool the fever death-rate was 13 per 1,000, with a previous five years' ratio of 22·1 per 1,000. The question suggests itself whether there be any local causes for these great differences in liability.

Take again the case of Nilgiri district. Why at such an elevation above sea-level should there have been a fever death-rate of 10·6 per 1·000 with a previous five years' ratio of 12·2 per 1,000? and why should the town of Ootacamund in this same district have yielded a fever death-rate in 1882 of 11·7 per 1,000? This town has a municipality, and yet its fever death-rate in 1882 would rank it among the most unhealthy towns of Madras. These and similar facts have been long known, but it is necessary to call attention to them from time to time as proving backwardness in sanitary work. On the other hand, we have an instance of Guntur, an improved municipal town in Kistna district, which returned a fever death-rate in 1882 of 2·8 per 1,000, while the district rate was 9·1 per 1,000, with a preceding five years' average of 8·8 per 1,000.

19. It is not easy to estimate the influence of rainfall on these local rates, because, generally speaking, this is determined by the presence of purely local conditions. We may, however, introduce the monthly fever mortality alongside the average monthly rainfall for the whole presidency to give a general idea of their relation to each other :—

Months.	Rainfall.	Fever Deaths.
	Inches.	
January	1·02	17,150
February	·04	15,008
March	·09	15,847
April	1·06	13,163
May	3·83	14,903
June	5·84	14,043
July	8·35	14,775
August	6·04	14,804
September	5·23	15,736
October	5·59	15,369
November	10·84	17,148
December	1·28	20,615
Total	37·33	98,447

The rainfall in this table represents the average of 233 places of observation, and the fever deaths of 225 circles of registration, both scattered over the whole presidency; nevertheless, as already stated, the fever death-rate varied greatly in different districts, leading to the conclusion that the effects of rain are very much under the influence of local conditions of soils, subsoils, and drainage facilities. A striking proof of this connexion between water-logging and drainage defects in localities is afforded by the case of the Kunathur fever, the local causes of which we described in a former memorandum. The matter was taken in hand by the collector of Chingleput, improvements were effected, and the Sanitary Commissioner describes the results in the present report. Referring to a previous report, in which he says will be found "Inspection notes on Kunathur and neighbouring villages, reported by "the collector of Chingleput to be desolated by an epidemic fever, with remedies suggested. It is "gratifying to be able to insert the following communication from the energetic collector, Mr. Price, "as the results of the measures carried out to remedy the state of things then existing:—'The long "'protracted outbreak of fever at Kunathur in the Saidapet taluk disappeared during the year, and "'the special medical staff employed was withdrawn.'" This was an instance of a most severe and fatal endemic fever of an aggravated type breaking out in a group of localities in an otherwise feverish country, where from local circumstances the subsoil surroundings and conditions had led to excessive damp or wet in the dwellings in addition to the usual insanitary state of Indian villages. The general rainfall had been about 46¼ inches, and the district fever death-rate 7·2 per 1,000, by no means an excessive rate for India, and yet for the aggravating causes stated the village deaths were those of a local pestilence.

The practical results of this experience have shown that, in dealing with epidemics in India, we must descend to details instead of contenting ourselves with general facts, and attack the evils in the villages and houses.

20. *Bowel complaints.*—Fatal diseases classed under this head were reported from 220 circles of registration out of 226 situated in all the districts, and from 58 towns out of 72. The death-rate for the towns averaged 2·0 per 1,000, and for the country circles 0·6 per 1,000. The monthly deaths from bowel complaints are shown in the following abstract :—

Months.	Bowel Complaint Deaths.	Months.	Bowel Complaint Deaths.
January	1,972	July	1,729
February	1,601	August	2,033
March	1,392	September	1,886
April	1,288	October	1,740
May	1,448	November	1,688
June	1,378	December	1,673

The most remarkable fact shown by the present year's statistics of bowel complaints is their great fatality in Madras, with 381,926 inhabitants. Among this population the deaths assigned to this cause were 2,047 in number, equal to 5·3 per 1,000, against a previous five years' rate of 6·5 per 1,000. Most of the districts return rates under 1 per 1,000.

21. *Injuries.*—Deaths under this head included the following numbers :—

Suicides, males	718
,, females	896
Wounds and accidents	7,665
Snake-bite and wild beasts	2,302
Total	11,611

22. Deaths registered under "all other causes" numbered 206,807 out of a total registered mortality of 470,700, and of these absolutely no account can be obtained in the present state of the registration.

23. Section VIII. of the report contains the statistics of European and native troops, together with sanitary notes on the stations. We shall discuss part of the detail of this section on other papers, and shall limit our present remarks to the more important features of the year's returns.

After adding increases of strength, and deducting all losses, the strength of European troops on 1st January 1883 was 11,528. The actual average strength would lie between this number and the strength on 1st January 1882, which was 10,521. We shall, however, adopt the ratios given by the Sanitary Commissioner for 1882, which stood as follows:—

Admissions per 1,000		-	-	-	1,069·4
Daily sick	,,	-	-	-	59·3
Total deaths	,,	-	-	-	10·4

The invaliding of 1882 is not given, but from another report we learn that it amounted for all reasons to 24 per 1,000.

The admission-rate was the lowest recorded in 23 years. The daily sick was about the average of the 11 lowest years of the same period, and the death-rate was the lowest on record except that of 1880, which was 9·9 per 1,000, and quite exceptional.

24. There were 11,658 admissions during the year, and 113 deaths. The most fatal disease was enteric fever, from which, according to the report under review, there were 47 admissions and 23 deaths.

Cholera yielded 15 cases and 9 deaths, but 8 cases and 5 deaths took place among troops on the march, and of the remainder two fatal cases took place at Secunderabad, one fatal case at Bellary, and one fatal case at Madras (Rangoon?). Remittent and continued fevers yielded 580 cases and three deaths. Intermittent fever caused 1,301 admissions to hospital.

There was extensive prevalence of hepatitis during the year. No fewer than 400 cases were admitted, of which 19 proved fatal. The chief admission cause of the year was, however, venereal diseases, of which 3,172 cases came under treatment, or 287·8 per 1,000 of the strength. These are the figures given by Dr. Stephens in his statistics. But in the report itself the annual ratio is 257·3 per 1,000, which is the highest ratio on record, affording, as remarked by the Sanitary Commissioner, "humiliating evidence of the inefficacy of police superintendence to prevent the propagation of this "loathsome malady."

25. *European women and children.*—The average strength of women was 834. Including 241 admissions for childbirth, the total admissions were 1,098, or 1,316·5 per 1,000. The deaths were 10, or 11·9 per 1,000. A remarkable feature of the female statistics is the absence of cholera. There was only one non-fatal case of enteric fever. There were six admissions from remittent fever, of which one proved fatal. The entire febrile group yielded only 112 admissions, and this single death. The admission-rate from fevers was 134 per 1,000, or 50 per 1,000 under the soldiers' rate.

European children numbered 1,444. The admissions to hospital were 1,439, or 996·5 per 1,000, and there were 41 deaths, or 28·3 per 1,000. Of these deaths two were caused by cholera, one by continued fever, and 27 by diseases incident to young children, convulsions, diarrhœa, teething, &c.

26. *Native Army.*—The approximate strength of the native army was 28,160, of which 23,795 were accounted for in the medical returns, and it is to this number that the disease statistics refer.

The admission-rate in the native army in 1882 was 866 per 1,000, the daily sick 32·2 per 1,000, and the deaths in hospital 12·4 per 1,000. Out of hospital the deaths were 2·6 per 1,000, making the native death-rate 15 per 1,000.

The invaliding rate was 39 per 1,000. Both the admission and daily sick rates were under those of European troops, but this circumstance is partly accounted for by the fact that the venereal admissions were 22·6 per 1,000, or about one-twelfth part of the ratio among European troops. The chief admission cause in the native army was fever—8,459 admissions and 61 deaths. There were 113 cases of cholera, of which 65 died.

The ratios among European troops contrast very favourably with these, and go to show the results of good sanitary work at the stations. But it must be also borne in mind that the sepoy who feeds himself is never in as good a condition as the European soldier, who is fed by the State.

27. *Sanitary Reports, Military.*—These consist of abstracts of a few lines each of reports received from 32 stations of British and native troops. They are generally satisfactory, apparently, to the reporters, but for practical purposes they are quite without value.

We are told, for example, that the sanitary state of Bellary was fair, and that of Kamptee, like Bellary, presented "no insanitary conditions to which the disease (fever) could be attributed," while, on turning to the statistics, we find that the admission-rate at Bellary was 2,170·8 per 1,000 in 1881, and 1,324·5 in 1882, and at Kamptee it was 1,415 per 1,000 in 1881, and 1,255·7 in 1882. Other similar cases might be given, but, with such facts before us, we cannot but regret that so little progress has been made in estimating the removable disease causes at Madras stations. If the ratios are inevitable results of occupying the stations, of course the only alternative is removing British troops from them.

28. *Health of Jails.*—At the close of 1881 there were 9,657 prisoners remaining in Madras jails. During 1882 there were 16,297 admissions, together 25,954; of these there were—

Liberated	14,152
Transferred	2,708
Transferred beyond sea	198
Escaped	2
Died in hospital	374
Died out of hospital	5
Executed	49

The average strength in all the jails in 1882 was 8,803. The total admissions into hospital were 7,046, the average daily sick about 254, and the deaths 369.

29. The sanitary history of Madras jails presents some points of great interest, which may be noticed, although they have been referred to in previous memoranda. In the years 1863 to 1866 the admission-rates were above 1,300 per 1,000, and the death-rates from above 10 per cent. to above 12½ per cent. Active measures for improving the administrative and sanitary arrangements were introduced, and the admission and death rates gradually fell until in 1871 the admissions were 779·9 per 1,000, and the deaths 17·9 per 1,000. After this year the death-rate rose, and in 1876, the year preceding the famine, it was 42·4 per 1,000, on an admission-rate of 703·6 per 1,000. It appears that in 1876, when the scarcity was commencing, the admissions were of a more severe character, and when the famine actually arrived in 1877 it led to the result shown in the following abstract, which also shows that since that disastrous period the death-rates have been returning to their former level:—

Years.	Ratio per 1,000 Strength.	
	Admissions.	Deaths.
1877	971·3	175·4
1878	944·4	125·4
1879	890·5	55·8
1880	854·0	44·7
1881	742·5	41·4
1882	800·4	41·9

The death-rate, upwards of 4 per cent., is still much too high, and shows that much lost ground has still to be regained.

30. The jail death-rates in 1882 from the chief diseases, as contrasted with the rates for 1865 in the old time, and for the famine year 1877, have stood as follows:—

Years.	Ratio per 1,000 Strength.		
	Cholera.	Dysentery.	Diarrhœa.
1865	80·	12·8	22·7
1877	25·7	32·1	50·1
1882	3·2	5·7	9·8

Cholera is, of course, a very variable factor, and in one year, 1874, the jails escaped its attacks altogether. As usually happens, the death-rates in different jails varied considerably in 1882. In six jails there were no deaths. The lowest registered death-rate was 5·7 per 1,000 in Cuddalore jail In other jails the rates exceeded 5, 6, and 8 per cent., and the highest rate of the year, 16½ per cent., was returned from Trichinopoly central jail. Among the death causes in 1882 may be enumerated fevers, from which about one-third of the year's admissions took place, but out of 2,402 cases there were only six deaths, "bearing out the remark," says the Sanitary Commissioner, "made elsewhere, "that these fevers are very amenable to treatment if only the patients, as in jails, could be made to "submit to it."

From cholera there were 54 admissions and 29 deaths, of which 34 admissions and 23 deaths were furnished by one jail of former evil repute at Coimbatore.

31. This outbreak presented one peculiarity, namely, that the debtors, juveniles, and females who were all near each other in the jail escaped the disease, while the male prisoners alone suffered, and the medical officer, after minute inquiry, could not trace any connexion between this endemic outbreak and cholera anywhere else. His view of the facts is that the outbreak might possibly have arisen from the percolation of polluted water into the wells supplying the male prisoners. It appears to be a fact, any way, that the prisoners who suffered and those who escaped used water from different wells.*

It is possible, nevertheless, that the cases might all have been part of the current epidemic, for Coimbatore district yielded 1,436 deaths, and the town six deaths during the year, and it is no unusual thing for a prevailing epidemic to swoop down and carry off its victims in ways of which no account can be furnished.

* In cases such as this, the suspected water should always be analyzed and the analysis reported.

32. A somewhat similar outbreak occurred in Madras Penitentiary, and as the dates are given in this instance we can obtain a better connected account of the facts than in the Coimbatore case.

Between the 20th November 1881 and the 14th December 1881 99 male prisoners and two females, all transport prisoners, arrived at Madras Penitentiary from 14 jails in different districts of the presidency, that is to say, 101 prisoners were added to the prison population. These prisoners were all carefully inspected and found free from cholera. At the date of their arrival the prison contained 673 males and 32 female prisoners. This prison is situated on the banks of the Coum, and its subsoil water level is 18 inches below the surface, varying according to the level of the foul river, so that on one occasion the medical officer "saw the female hospital flooded to a considerable depth owing to the rising of the Coum." There are, besides, two large overcrowded graveyards in its immediate vicinity. Nevertheless, this prison has experienced remarkable immunity from cholera for years past. We have here the local causes apparently inactive until the prison population has been increased from 705 to 806, but, as occurs in all epidemic outbreaks, there must be something else present to cause the explosion, and this is the epidemic itself.

It so happens that in 1881–82 there was a very distinct cholera epidemic among the 321,926 inhabitants of Madras district, from which the following mortality resulted :—

Months.	Deaths from Cholera.	Months.	Deaths from Cholera.
1881.		1882.	
October	2	January	153
November	40	February	175
December	81	March	74
		April	20
		May	4

It will be seen that the addition of 101 prisoners to those already in the jail took place during a local epidemic of cholera, from which 549 of the civil population died; and bearing these facts in mind, we shall be better able to understand the prison outbreak.

The local prisoners presented no suspicious case of disease at lock-up hour on 4th January 1882, but at 6 p.m. two prisoners were attacked with cholera, and between the 4th and 13th January there were in all 11 cases and 4 deaths.

Let us see now what occurred among the transports. At 4 p.m. on 3rd January (26 hours before the prison outbreak) 98 of them were embarked on board ship, and three were retained as being too old for deportation. There was no choleraic disease among them; they had a hot meal before starting. But "they got no food next day till 6 p.m." (that is, on the 4th), "when badly cooked rations were served out." On the 5th there were a few cases of diarrhœa, and one man died in the evening. On the 6th there were four choleraic attacks, and one man died on the morning of the 7th, just before entering the port of Vizagapatam. At that time there were six vomiting and purging cases, three of which were collapsed. The sick were landed and camped out, after which two fresh cases were admitted. The total admissions were seven men, of whom six died, and there was no spread of disease in the town.

This case is one of considerable importance, and the whole outbreak was confined to men who were exposed during an epidemic to distinct local and epidemic conditions at Madras. Part of the Madras prisoners were left there and part of the transports were removed by sea, and both groups were attacked with cholera nearly at the same time. The question suggests itself whether either group would have suffered if the transports had not been taken into jail. The rule during epidemics is always to reduce and disperse the population, whether of crowded localities, or of barracks, or of jails, but never to make additions to the populations as long as the epidemic is present.

33. *Municipalities.*—There are 47 municipal towns, besides Madras town, which is reported on separately. Their aggregate population, including Madras, was 1,729,818 at the census of 1881, showing an increase of 116,068 since the previous census of 1871. This census number was 1,613,750, which, in default of census details for 1881, is used in the town statistics.

The general birth-rate was 33·1 per 1,000, and the death-rate 28 per 1,000, both ratios showing improved registration. The death-rate was 3·2 per 1,000 under the previous five years' rate.

The following are the registered death causes in the municipal towns in 1882 :—

Diseases.	Total Deaths.	Deaths per 1,000.
Cholera	3,512	2·1
Small-pox	2,393	1·4
Fevers	9,947	6·1
Bowel complaints	5,076	3·1
Injuries	585	0·3
Other causes	23,784	14·7
Total deaths	45,296	28·0
Total births	53,450	33·1

The population within municipal limits exceeds the population of the towns, so that the total population under municipal administration in 1882 was somewhere about 2,324,000.

Exclusive of Madras town the estimated income for all the other municipalities was Rs. 15,96,920, or Rs. 1·5 per head of the population. The amount set apart for sanitary purposes in the official year 1882–83 was Rs. 495,536, or 31 per cent. of the income. The expenditure under special heads is only given for nine months ending 31st December 1882, and it stood as follows:—

	Rs.
Conservancy	247,781
Improving town sites	26,627
Improving water-supply	16,567
Markets	8,377
Latrines, dust bins, &c.	35,356
Total	354,708

In a previous section we have given the officers in the vaccination service, and we may here introduce a list of officials employed in the 47 municipal towns furnishing this account of expenditure.

Deducting Madras town, we may assume their population at about 1,330,000, and their staff in 1882 stood as follows:—

Inspectors	20
Supervisors	46
Overseers	22
Maistries	52
Peons	166
Sweepers	2,378
Tank watchers	52
Total sanitary staff	3,336

Their material was as follows:—

Carts	870
Dust bins	4,526
Public latrines	362

It cannot be denied that if the conservancy work done corresponded in a reasonable degree to the means provided for doing it, there must have been a large amount of useful current sanitary work carried out in 1882, and it is not unreasonable to conclude that part of the reduction in death-rate, which in 1882 was 3·2 per 1,000 under the previous five years' average, may have been due to this work.

A brief abstract is given of the year's work in each municipality, but there is little in these abstracts calling for remark. Nothing in the nature of permanent sanitary works appears to have been carried out during the year.

Cleansing has been more or less carried on, but it appears to have been chiefly outside work, while, as is well known, the want of conservancy is greatest in compounds and inside houses, including removal of cattle. There is no drainage properly so called; what drainage there is is mostly surface drainage of public thoroughfares, which is chiefly effected by cuts in the soil, without any adequate provision for keeping sewage and rainfall out of the subsoil. The large town of Bellary, with a population of some 50,000, has cesspools, its drainage is unsatisfactory, and its five year's death-rate had exceeded 3½ per cent.

Generally speaking, the water-supply from tanks, wells, and rivers is favourably reported on, and in some cases watchers are appointed to keep people from fouling the supplies.

Taking the year's facts as a whole, they lead to this conclusion, that the chief disease causes in these towns are connected with a polluted condition of the subsoil, due to absorption of liquid sewage. We have discussed the remedies required in our "Suggestions for the sanitary improvement of Indian stations and their vicinity," and to those we must refer for details.

The municipal towns vary in population. Some of them could be dealt with on the principles we have laid down for small municipalities, but for the larger towns water-supply and drainage schemes would, so far as we can judge, afford the only real safeguards from epidemics. In all of them the cardinal improvement required is constant cleansing and removal of all sewage impurities, so as to keep them out of the subsoil, either by hand labour or by engineering, water-supply, and drainage works. It must, however, be acknowledged that, taking the municipal reports as a whole, they show that good work is being done.

34 *Local Fund Circles.*—There are 30 of these circles, and they include a population of 28,812,226, which includes the total rural population of Madras Presidency, besides that of some small towns. The birth-rate is stated at 24·2 per 1,000, and death-rate at 15 per 1,000 probably not half the real death-rate.

The local fund circles contain 47,250 villages, of which only 640 have hitherto been brought under conservancy work. The total income of all the circles, one-third of the land cess, amounted for the year to Rs. 13,41,991, of which 27·9 per cent. was appropriated for sanitary purposes. The actual sanitary allotment was Rs. 3,74,689, and of this the amount expended was Rs. 2,11,192 (21,119*l.* for the sanitary improvement of the whole rural population). Nothing can show more clearly how languidly the work is carried on in these circles than the facts of expenditure. For example, the sum set apart for conservancy was 18,179*l.*, while the sum actually spent was 12,406*l.* Again, one of the most important works insisted on by the Madras Government, the improvement of village sites, had 3,094*l.* set apart for it, no great amount certainly, but the sum actually expended was no more than 1,043*l.* For improving the water-supply a sum of 12,394*l.* was sanctioned, but the amount spent on this cardinal improvement was 4,987*l.* The largest amount spent in proportion to the allotment was 2,287*l.* out of 2,704*l.* set apart for latrines, dust bins, drains, &c. The accounts are, however, only given for nine months, but the proportions of expenditure to allotment do not vary materially from those of the preceding entire year's period. This was an outlay of 28,947*l.* out of an allotment of 37,415*l.* for the official year 1881–82.

The general nature of sanitary work during the year can be learnt from the money spent under the different heads, and there is little in the circle reports calling for remark. We may, however, abstract the following statement of Mr. Price, one of the most zealous workers in India in the public health cause, as showing the great difficulties which have to be encountered at present. Referring to village sanitation he says, "There is no money to speak of, and there is no law by means of which to enforce "anything, but notwithstanding this, district officers are,—if the Sanitary Commissioner sees dirt, and "things that are opposed to all sanitary dicta, and this he always does,—called upon by their superiors "to take measures, &c., or to bring it before their impecunious local boards, or something of this "sort. Of course, officers, if they choose to take the trouble, can by their influence do a good deal, "and where cholera appears the people grow frightened and help them; but something more than "this is wanted, and no appreciable sanitary work can be done until there is a law to help officials to "enforce cleanliness, and one which will allow of funds being raised in villages of any size, in view "to their being kept clean."

It is the keeping clean of villages and the protection of water sources which constitute the real safeguards against epidemics, and not any amount of spasmodic activity, which may lead to positive mischief, by disturbing filth and filth heaps when cholera has appeared. Epidemics of all kinds are nothing more than the penalties of past and possibly forgotten neglects of public and private responsibilities.

35. *General remarks and personal proceedings.*—Under this section, Dr. Furnell gives a general account of the year's sanitary work in a number of districts which includes some points of interest. He states generally "that considerable progress has been made in sanitation in the various "municipalities and small towns under local fund boards. This is more marked in some districts "than in others, and depends much on the interest taken in such matters by presidents and vice-"presidents."

This remark shows distinctly that much may be done by official agency and influence, but the statement which follows refers to other agency. He says, "a public feeling in this matter outside "mere official circles has unquestionably arisen, and in my tours I met many intelligent native "gentlemen giving a considerable portion of their time and energies to municipal matters," and then follows this hopeful statement:—"In some districts, Madura and Bellary for example, sanitary "associations have been started by the inhabitants of towns not quite large enough to claim the "honour of a municipality, and by this agency improvements in drainage, scavenging, water "conservancy, and lighting are being carried out." Movements of this class will likely, in the end, lead to municipal government and sanitary law. In the meantime it may be suggested that similar committees in large villages might be of use.

In one district, Anantapur, the following procedure has been adopted with advantage. The Medical Sanitary Officer inspects part of the town and enters the result, with his recommendations, in a book which is passed on the same day to the executive officer, who at once sees to the carrying out of necessary improvements. Once a month the book is sent to the divisional officer, who enters his remarks and passes it to his President. In the meantime another book is in the same course of use, so that a constant system of inspection is carried out with the result that three towns under it "are the cleanest places I have yet inspected" says the Sanitary Commissioner.

36. In the course of the year Dr. Furnell visited Pondicherry with the view of examining the water supply of this French settlement, which is obtained by artesian wells. This is a favourite source with the French authorities, not only in France, but in Algeria, where these wells are scattered all over the country. The Pondicherry wells afford plenty of water sufficiently pure for all purposes, and the cost is not great—about Rs. 2,000 each. The facts have been fully reported to the Madras Government, and it will be sufficient simply to give the conclusions of the Sanitary Commissioner as follows:—

"We have presented to us a town furnished with what must be considered the most essential "necessary of a tropical city, an ample supply of clean water. There are no less than 14 artesian wells "in the place, some ten of which belong to the public. There is besides a supply of water conducted "from a distance, and laid on with pipes in the city. In every street you see hydrants with stop-"cocks, from which the people draw water." And then we have this statement as a matter of fact about cholera alongside the other fact, that the people do not use, as in most Indian towns, foul subsoil drainage for domestic purposes.

"Cholera, during 1881–82 and commencement of this year (1883), has twice swept past Pondicherry, playing sad havoc in the towns of South Arcot contiguous to the French territory, viz., Cuddalore, Porto Novo, Villupuram, Chidanbaram, Negapatam, &c., and yet has never effected a lodgment in Pondicherry. It has also visited the towns lying on the same littoral, and apparently enjoying the same localistic influences."

We are glad to see that one of these attacked towns, Negapatam, is bestirring itself on the subject of artesian wells, but it must be added that so long ago as 1865 the French practice in Algeria was detailed in the report of the Commission appointed to inquire into causes of improved health in the French army there; so that the use of artesian wells is no new revelation to the Indian authorities.

In conclusion, the chief practical result of the Report under review has been to show how small a relation there is between the ascertained sanitary needs of the vast population of Madras Presidency and the practical steps which have been as yet taken to meet them. What is wanted for the whole Presidency is an active sanitary executive, to turn to account the information which has been obtained by the annual inspections of the Sanitary Commissioner and his assistants. There is nothing specially difficult to be done. But one thing is obvious enough, that if the public health is an object worth caring for, the Executive must take a very different position in the matter than it has yet done. Whilst stating this conclusion, we desire in no degree to undervalue what has been done in the towns, but they contain only a fraction of the population; and it is among these uncared-for outside groups that epidemics have their home.

1st August 1884.

No. 3.

Memorandum of the Army Sanitary Commission on the Report of the Sanitary Commissioner for Bombay for 1882, with Appendix.

This report has been drawn up by Mr. Lumsdaine, the retiring Sanitary Commissioner, and there are bound up with it three reports of inspections made by Deputy-Surgeon General Hewlett, of the cantonments of Nusseerabad, Neemuch, and Mhow, with special reference to the discovery of disease causes at these stations.

There is also another report by Mr. Hewlett on enteric fever among troops serving at Bombay stations, and, as the year's work is very voluminous, it will be better to confine the present Memorandum strictly to Mr. Lumsdaine's Report, and to deal with the others separately.

1. The total area of Bombay Presidency is 123,860 square miles, and the population on the night of the 17th February 1881, amounted to—

Males	8,497,718
Females	7,956,696
Total	16,454,414

giving an average density of population 132·85 per square mile. The most densely populated area is the city of Bombay, which has 35,145·27 inhabitants per square mile. The most sparsely peopled district is Thar and Parkar, which has 15·98 per square mile.

2. The births registered in 1882 were as follows:—

Males	255,927
Females	235,419
Total	491,346

The male birth-rate was 30·12, and the female birth-rate, 29·59. The general rate for 1882 was 29·86 per 1,000 of population.

3. In the same year, the following deaths were registered,—

Males	181,835
Females	161,583
Total	343,418

The death-rate was for males 21·40 per 1,000; for females 20·31 per 1,000, and for the whole population, 20·87 per 1,000.

4. The next abstract gives the statistical data for each district of Bombay.

Districts.	Population, 1881.	Area in Square Miles.	Births per 1,000 1882.	Mean Birth-rate for 9 Years on Population of 1872.	Deaths per 1,000 of Population.	
					1882.	Previous 5 Years.
Khandesh	1,237,231	9,944	36·85	21·18	22·07	24·75
Nasik	781,206	5,940	35·17	24·45	24·77	28·41
Ahmednagar	751,228	6,666	39·12	24·58	19·51	28·79
Poona	900,621	5,348	27·48	19·09	17·84	23·57
Sholapur	582,427	4,521	34·57	15·16	18·99	31·04
Satara	1,062,350	4,988	39·06	25·07	22·62	29·71
Belgaum	864,014	4,657	37·59	23·40	23·17	39·73
Dharwar	852,907	4,335	44·05	24·59	22·58	30·93
Kaladji	638,493	5,757	35·32	15·32	19·10	36·90
Kanara	421,840	3,911	29·93	28·45	25·61	37·99
Ratnagiri	997,090	3,922	20·68	14·28	14·68	19·79
Kolaba	381,649	1,496	24·05	16·01	12·07	16·73
Bombay City	773,196	22	19·52	21·56	26·16	37·55
Thana	908,548	4,243	28·50	21·45	22·09	28·13
Surat	614,198	1,662	35·55	28·10	22·81	26·02
Broach	326,930	1,453	28·58	15·27	20·35	33·34
Kaira	804,800	1,609	32·85	22·32	22·33	31·87
Panch Mahals	255,478	1,613	26·67	18·28	15·98	27·62
Ahmedabad	856,324	3,821	27·32	19·50	24·20	31·84
Kurrachee	478,588	14,115	20·42	9·40	18·40	16·93
Hyderabad	754,624	9,080	11·62	6·42	14·58	12·56
Thar and Parkar	203,344	12,729	24·89	10·00	17·20	15·05
Shikarpur	852,986	10,001	20·22	6·71	20·82	9·61
Upper Sind Frontier	134,181	1,877	10·51	6·96	9·90	7·86

This district abstract affords a history of registration of births and deaths for 10 years in the case of births, and for six years in the case of deaths, and although we could scarcely accept the figures as accurate, they, nevertheless, show that great pains have been taken with the registration, and that improvement in the results is being attained.

5. The population and death-rates among different classes in Bombay Presidency in 1882 were as follow:—

Classes.	Population on the Census of 1881.	Death-rates per 1,000, 1882.
Mahomedans	3,106,482	17·88
Hindus	13,128,729	21·49
Christians	138,326	18·29
Other classes	80,877	39·17
Total	16,454,414	20·87

This abstract shows that the registration of deaths is very deficient among all classes of the Bombay population, except the last in the list, which is probably nearer the truth than any of the others.

6. In order to complete this sketch of the year's registration work, we may insert the deaths, according to age and sex, together with the death ratios registered in each month of 1882.

Ages.	Death-rates per 1,000 living.	
	Males.	Females.
Under 1 year	179·60	152·14
1 and under 5	34·97	32·07
5 „ 10	7·72	7·59
10 „ 15	5·36	6·39
15 „ 20	8·53	10·84
20 „ 30	11·02	12·33
30 „ 40	14·56	13·19
40 „ 50	22·15	16·28
50 „ 60	34·21	26·54
60 and upwards	56·61	48·40

The next abstract gives the ratio of deaths per 1,000 of the population of Bombay Presidency registered in each month of 1882.

Months.	Deaths per 1,000 of Population.	Months.	Deaths per 1,000 of Population.
nuary - -	1·81	July - - -	1·62
bruary - -	1·67	August - -	1·82
arch - -	1·78	September - -	1·75
pril - -	1·61	October - -	1·81
May - - -	1·72	November - -	1·99
June - - -	1·46	December - -	1·85

We have ventured to give this monthly abstract of deaths because any errors in registration are more likely to be diminished in importance by representing the monthly figures, absolutely returned at the time, in a case where there is no reason to think that errors in registration and report differed materially in different months.

The table may thus be accepted as representing if not the absolute, at least the relative mortality of different months, and there is no mistaking the influence of season on the death-rates represented in this abstract.

7. We shall next give the registered causes of mortality in 1882, together with the disease history of the year. The following were the registered death-causes for the whole Presidency in 1882, classified under the usual heads:—

Death causes.	Total Deaths.	Deaths per 1,000 of Population.
Cholera - - - -	7,904	0·48
Small-pox - - - -	1,630	0·10
Fevers - - - -	243,434	14·80
Bowel complaints - - -	28,353	1·72
Injuries - - - -	5,913	0·36
All other causes - - -	56,164	3·41
All causes - - -	343,418	20·87

This abstract shows how very subordinate a death-cause cholera was in 1882. The greater part of the year's mortality was due to fever, while cholera gave rise to less than a forty-third part of the total deaths.

8. We shall follow our usual course in discussing the disease history of the year, beginning with cholera. In the month of January 1882 cholera deaths were reported from Khandesh and Ahmednagar, in the Northern Deccan, from Satara, in the Southern Deccan, from all the districts in the Konkan, including Bombay city, and from Surat, in Gujarat. In this month 272 cholera deaths were registered. In Konkan the disease was a distinct epidemic outbreak, fading away after March, but with an increase of mortality after July. In the Southern Deccan cholera assumed the epidemic character in April, and retained it for the rest of the year. In the Northern Deccan cholera became epidemic in June, and faded away in November. In Gujarat cholera was irregularly distributed in locality and time, and in Sind there were only three cholera deaths in May. The following abstract gives the monthly attacks and deaths for the Presidency:—

Months.	Cases of Cholera.	Deaths from Cholera.	Months.	Cases of Cholera.	Deaths from Cholera.
January - -	434	272	July - - -	2,040	908
February - -	456	297	August - -	2,582	1,156
March - - -	458	351	September - -	1,305	612
April - - -	1,625	754	October - -	814	362
May - - -	4,114	1,835	November - -	322	146
June - - -	2,413	1,170	December - -	113	41

9. Although cholera deaths were registered in all the divisions, they were reported from 125 circles of registration out of 286 in the Presidency, and, out of 24,431 population groups, the whole 7,904 deaths took place in 804 only. As already stated, the death-rate from cholera was 0·48 per 1,000, the previous five years' ratio having been 1·58 per 1,000. The town death-rate slightly exceeded the district rate of the year. It was 0·50. There are 63 towns in the Presidency, of which 27 yielded the whole town mortality, which amounted to 1,052 cholera deaths.

The epidemic of 1882 was thus irregular in its incidence, both as regards time and locality. It showed no tendency to spread in any definite direction, and it left by far the largest part of the country untouched. It consisted apparently of 804 separate outbreaks, during which about 10 deaths on an average in each attacked group yielded the whole epidemic mortality of the year.

10. Among the population groups may be instanced Bombay itself, with its dense crowded population of nearly three-quarters of a million, which yielded 190 deaths from cholera, or 0·25 per 1,000, just one-half of the average town rate, a result which may be fairly placed to the account of efficient sanitary work done in past years.

11. In a preceding abstract we have placed together the monthly attacks and deaths from cholera. The total reported cases of the epidemic amounted to 16,676 and the deaths to 7,904, or 47·40 per cent. of the attacks; but it is worthy of remark that the higher percentages of deaths to attacks, namely, 62·67, 65·13, and 76·64 per cent., all took place in the three first months of the year at the outbreak of the epidemic, and that, as the severity of the epidemic declined in the last three months of the year, the percentages of deaths fell to 44·47, 45·34, and 36·28. This is what usually takes place during epidemics.

12. Although the cholera death-rate, when taken over the whole population of the province, was only 0·48 per 1,000, this rate does not represent the real ratio among affected groups of population. The 804 affected villages contained a population of 1,341,947. The district deaths, as already stated, were 6,852, and this number would yield a death-rate of about 5 per 1,000 for the country population groups which suffered, or just twenty-fold the death-rate of Bombay City, the population of which is more than a half of that of all the affected villages taken together. We naturally ask the question why measures which have been so beneficial in the capital of the province cannot be applied to all these small population groups?

13. Before concluding this sketch of the history of cholera for 1882, it is necessary, in order to know exactly where we are in coping with the disease, to introduce its previous history, which has been as follows for the 16 years preceding:—

Years.	Cholera.		Years.	Cholera.	
	Total Deaths.	Deaths per 1,000.		Total Deaths.	Deaths per 1,000.
1866 - - -	23,627	1·85	1874 - - -	37	0·01
1867 - - -	5,143	0·32	1875 - - -	47,555	2·93
1868 - - -	6,347	0·50	1876 - - -	32,117	1·98
1869 - - -	52,390	3·77	1877 - - -	57,252	3·54
1870 - - -	2,666	0·20	1878 - - -	46,743	2·89
1871 - - -	5,821	0·41	1879 - - -	6,937	0·43
1872 - - -	15,542	1·03	1880 - - -	684	0·04
1873 - - -	283	0·02	1881 - - -	16,694	1·01

The years 1876–77–78 include that disastrous time when epidemics co-existed with famine and scarcity. But, including these years, the mean cholera death-rate for the whole period was 1·31 per 1,000 against 0·48 per 1,000 in 1882. This shows a very considerable decrease of mortality, especially if we assume that 1882 was one of the years of maximum mortality of which the table shows a recurrence every third year.

14. Facts of the same class for each district given in the following abstract show where the reductions of mortality in 1882 took place.

Districts.	Cholera Death-rates per 1,000.		Districts.	Cholera Death-rates per 1,000.	
	16 Years.	1882.		16 Years.	1882.
Khandesh - -	1·41	0·11	Ratnagiri - -	0·48	0·10
Nasik - - -	1·06	0·38	Kolaba - -	0·36	0·39
Ahmednagar - -	1·86	0·24	Bombay City - -	0·74	0·25
Poona - -	1·54	0·23	Thana - -	1·23	0·85
Sholapur - -	2·06	0·82	Surat - -	1·18	0·01
Satara - -	1·89	2·26	Broach - -	0·89	—
Belgaum - -	2·35	1·54	Kaira - -	0·68	0·33
Dharwar - -	2·34	0·15	Ahmedabad - -	0·79	0·30
Kaladgi - -	2·31	0·85	Thar and Parkar -	0·27	0·01

It will be seen that in all the districts, with two exceptions only, there was a large falling off of epidemic mortality in 1882, notwithstanding the fact already stated that this year was one of the recurring years of high cholera prevalence. The district which suffered most in 1882 was Satara, where there was a distinct local epidemic outburst, from the effects of which 2,406 people, out of a population of 1,062,350, died. Reduced cholera death-rates in 1882 otherwise extend all over the Presidency, and apply to districts which were not the seats of famine; so that, as a matter of fact, cholera appears to be less fatal than it was, although it still covers the whole area of the Presidency.

It is right, at the same time, to state that much good sanitary work has been done in these years, especially in Bombay City and in the other larger groups of population.

15. The relation of epidemic intensity to population is shown in the Satara case as follows:—The proportion of attacked villages to the total villages taken over the whole Presidency was 3·3 per cent., and the deaths averaged about 9·8 per attacked village; while in Satara district 18 per cent. of the villages suffered, and the deaths were a little over 10 per attacked village. The proportion of population groups attacked in Satara was nearly six times the proportion in the Presidency generally, but the local intensity in localities where the disease prevailed was not much greater.

The report of the deputy sanitary commissioner enables us to carry this interesting and important point of cholera history still further, in the case of Valva taluka, which had a population in 1872 of 136,089. In the taluka there are 136 villages, of which 39 were attacked with cholera in 1882. The ratio of attacked villages was not 3·3 per cent., as in the province generally, nor was it 18 per cent. as in the case of Satara district, within which Valva is situated; but the attacked villages in this taluka amounted to no less than 48·67 per cent. of the total number. These 39 attacked villages yielded 1881 cholera attacks and 889 deaths, or nearly 23 per village.

16. The incidence of all epidemics appears to be the same in kind. The first result of the statistical method of inquiry was to afford a general idea of death ratios over entire countries. It was next found that certain administrative areas suffered more than others; and then, that within these areas epidemics were more fatal in some defined spots than in the rest of the area.

The Satara case, and a similar case in Belgaum, are of the same kind; and just as we find in our towns that epidemic deaths are mainly due at any given time to particular streets or courts, so in these Indian villages it may also be predicted that the mortality of a village may be chiefly due to a few houses in it. This consideration brings us back to the question of local predisposition and its causes; and hence the practical conclusion of the whole matter is, that known epidemic or endemic localities are the first that ought to be dealt with in forwarding sanitary work, and that cleansing and wholesome water-supply ought not to be left until cholera has attacked the people, because by that time they have already incurred the penalty of previous neglects.

17. The Sanitary Commissioner has introduced into the cholera section of this Report a considerable amount of local cholera history, including dates of attack and other points, of which a few may be noticed as throwing some light on the year's epidemic history.

First, there is no proof that local outbreaks were other than portions of the general epidemic. There were the usual local opinions that the first case had come from an affected locality, but on inquiry nothing could be made of them. The attacks appeared to have resembled local rainfalls rather than floods of water traversing a country.

Among predisposing local conditions are enumerated sites of villages on river banks, filth, want of drainage, bad water, overcrowding of insanitary houses. Local causes of this class may be illustrated by the following history of an outbreak of cholera in the horwád of Kapadvanj, in Kaira. The town has a population of 14,442, which yielded 139 cholera deaths. "The sanitary condition of the horwád "at this time was as under:—A densely populated area with narrow streets and tall houses of two "or more stories, containing within it about 500 deep-well privies and 100 drinking wells, most of "which are in close proximity to the deep-well privies. As it was the monsoon season, the *moris* "of all the houses were allowed to run out, and thus the streets contained in the centre more or less "stagnant open drains of filthy matter. To this may be added the usual filthy collections of surface "refuse. Such was the sanitary condition of the horwád."

18. By way of contrast to this case, we shall here give the cholera statistics of Bombay city, with its three-quarters of a million of inhabitants, for a period of 34 years.

Years.	Deaths from Cholera.	Years.	Deaths from Cholera.
1848	69	1865	3,887
1849	2,128	1866	339
1850	2,997	1867	121
1851	5,435	1868	227
1852	1,520	1869	754
1853	1,148	1870	386
1854	3,507	1871	263
1855	1,645	1872	190
1856	1,846	1873	92
1857	2,181	1874	19
1858	115	1875	834
1859	1,985	1876	374
1860	1,961	1877	2,510
1861	641	1878	1,165
1862	3,170	1879	323
1863	2,209	1880	39
1864	4,847	1881	529
17 years	37,454	17 years	12,026

The first 17 years' column in this table gives the cholera deaths before sanitary work was begun. There were during this period 37,454 epidemic deaths. During the 17 years in the second column, notwithstanding greater accuracy of registration, the deaths had not increased, but on the contrary had fallen to less than a third. But in this third is included the cholera mortality of the famine years 1877–78, when Bombay became crowded by famine-stricken fugitives from the adjacent districts. The average

of annual deaths during the 34 years was 1,426, while in 1882 the number was 190. During the years in the second column certain very important changes have been in progress in the city. The first and most important of these was the introduction of a thorough systematic cleansing and keeping clean of the whole place. During the same years progress was being made in supplying the population with good water laid on from the Vehar and Tulsi reservoirs by gravitation. This great work is not yet completed, but it is hoped will soon be so, and the main drainage of the city has been making progress. The one work which was well done from the beginning was the cleansing, and without undervaluing the influence unquestionably exercised by better water on the public health, we feel that the main practical lesson taught by the Bombay City experience, and which is applicable at little or no cost to every town and village in the Presidency, is that, the war against cholera must, beyond a doubt, be carried forward by cleansing and keeping clean every village and house compound in the country districts.

19. Cholera in Bombay city in 1882 fell chiefly on the population of Parell village, which "has no "system of drainage. The drainage is either received into cesspools or runs into open channels "which discharge into low lying ground. One portion of the drainage soaks into the ground "of Government House compound, and is so disposed of. The well water used by the attacked "group of population was very impure," and "totally unfit for drinking."

We have in this case an ordinary Indian village outbreak of cholera, under the usual conditions accompanying Indian village attacks, while the great population of the city in contact with it almost escapes, under improved cleansing, better water-supply, and advancing drainage.

20. So far as any account is given of sanitary work among affected groups of population, these measures included collection and removal, for burning at a distance, of surface refuse. But an important distinction is made with regard to accumulations of filth and manure, which were not disturbed, but covered with fresh earth. This is in entire accordance with sound sanitary procedure, which requires in all cities and villages that the current cleansing should be sufficient for every purpose of protection, and that no stirring up of filth should be permitted when cholera is in the place. It has not unfrequently been the practice to cleanse imperfectly, and then, when cholera threatened, to put on an additional staff, to make up for previous neglect, a proceeding always more or less hazardous during epidemics.

These appear to be the chief points requiring notice in the cholera history of 1882.

21. *Small-pox.*—The following abstract shows the annual mortality from small-pox in Bombay Presidency since the year 1872:—

Years.	Deaths from Small-pox.	Years.	Deaths from Small-pox.
1872	26,699	1877	27,869
1873	9,935	1878	4,475
1874	3,903	1879	1,156
1875	3,461	1880	940
1876	11,817	1881	539

It will be observed that small-pox in Bombay shows a tendency to periodical epidemics of considerable intensity, but that the year 1881, even with improving registration, yielded the smallest annual mortality on record. The average annual deaths up to 1880 had been 9,973, or 0·61 per 1,000 of the population; in 1881 the ratio had fallen to 0·03, or about a twentieth part of the preceding nine years' average. The small-pox deaths in 1882 had increased to 1,630, or 0·10 per 1,000 of the census population, but the average was still only a sixth part of that of the same nine years.

22. Small-pox deaths were returned from all the 24 districts, with two exceptions, but only from 95 registration circles out of 286, and the whole year's mortality took place in 357 villages, out of a total of 24,431.

The following monthly deaths bear marks of two epidemics, the latter of which took place chiefly in Poona and Thana districts:—

Months, 1882.	Small-pox Deaths.	Months, 1882.	Small-pox Deaths.
January	41	July	148
February	45	August	98
March	66	September	81
April	107	October	98
May	120	November	201
June	146	December	479

Poona district yielded the highest small-pox death-rate of the year, ·56 per 1,000, and out of 1,172 villages, no fewer than 106 suffered. Of the 1,630 deaths in the whole Presidency, 444 were returned from 22 towns out of 63. The town death-rate, ·21 per 1,000, was more than double the district rate, namely, ·08 per 1,000.

Arranged according to ages, the small-pox deaths were as follow :—

Ages.	Deaths.
Under 1 year	311
1 and under 12	563
Above 12	756
Total	1,630

and these figures bring us to the question of vaccination, which for many years past has occupied a prominent place among public health measures in Bombay.

23. The Report gives fully the departmental history of vaccination, which lies beyond our province, but we abstract a few figures from it, which may in some sense throw light on the death statistics already given.

The staff for the official year 1882–83 stood as follows :—

Deputy Sanitary Commissioners	5
Superintendents of Vaccination	3
Inspectors of Sanitation and Vaccination	51
Assistant Superintendents of Vaccination	5
Clerks and karkuns	28
Vaccinators, candidates	455

The total operations performed by this staff in 1882–83 consisted of—

Vaccinations	792,206
Re-vaccinations	66,505
Total for the official year	858,711

Vaccinations according to age stood as follows :—

Ages.	Vaccinations.	
	Total Number.	Successful.
Under 1 year	485,661	468,594
Between 1 and 5 years	284,141	273,132
All other ages	22,404	20,019
Total of Presidency	792,206	761,745

24. The year's results of the vaccination service may be stated as follows:—

Total births registered	491,346
Successful vaccinations under one year	468,594
Small-pox deaths under one year	311
Total successful vaccinations, all ages	761,745
Total small-pox deaths, all ages	1,630

In contrasting these figures, we must bear in mind the epidemic character of small-pox, as shown in a preceding table, but we must also bear in mind that vaccination work of this class is no new thing in Bombay. It has been carried on year after year, and there appears to be reason for believing that the population is becoming less liable to outbreaks of this disease. One really practical lesson which the Bombay experience teaches is that everywhere the greatest gain from vaccination will be obtained by directing the efforts of the vaccination staff as much as possible to the protection of infants, because not only is infant life saved, but the protection is carried into after life. It follows that it is of much greater importance to vaccinate an infant successfully than it is to delay the operation or to vaccinate an adult.

25. As the remainder of the year's disease history is not connected in the present Report with local disease causes, we shall simply give the statistical results for the year.

Fevers.—Diseases classed under this head were, as usually happens, by far the most important death causes in 1882, although there was a decrease of mortality so registered of 28,949 deaths below the number of the preceding year, and of 6,124 deaths below the mean of the nine years, 1872 to 1880, during which years the fever deaths were as follow, with the addition of 1881 :—

Years.	Fever Deaths.	Years.	Fever Deaths.
1872	206,747	1877	336,865
1873	188,201	1878	357,376
1874	183,717	1879	286,526
1875	219,156	1880	246,779
1876	220,833	1881	272,403

The registered fever deaths in 1882 were 243,454. Fever registration appears to have been defective during the first three years of the series, but from 1875 and onwards the great increase in fever mortality during the famine and scarcity years is strikingly shown, and since then the mortality has declined.

The fever death-rate for the first nine years in the table was 15·38 per 1,000 of the population. In 1881 the rate was 16·56, and in 1882 it was 14·80 per 1,000. During the whole period in the table the chief sufferer has been Ahmedabad district, which, for some reason or other, has registered a fever death-rate for the first nine years in the table of 20·67 per 1,000, which attained to 24·82 per 1,000 in 1881, and was 18·88 in 1882.

In the rural circles the fever death-rate of 1882 was 15·15 per 1,000, and in the towns, all of which suffered more or less, the rate was 12·36 per 1,000.

Fever deaths were returned from all the 286 registration circles, and from 22,302 villages out of 24,431 in the Presidency.

26. The following abstract shows the monthly prevalence of fever mortality in 1882 :—

Months.	Fever Deaths.	Months.	Fever Deaths.
January - -	21,985	July - - -	17,314
February - -	20,236	August - -	19,534
March - - -	21,905	September - -	19,654
April - - -	18,745	October - -	21,648
May - - -	19,088	November - -	25,257
June - - -	15,557	December - -	22,531

So far as concerns the relation of fever mortality to climatic causes, this abstract appears to show that drying up after rain and variable temperatures with cold tend to raise fever mortality, but, as already stated, there are no facts in the Report to show how far climatic causes may have been influenced by local insanitary conditions, especially as regards sources of malaria.

27. *Bowel complaints.*—Deaths registered from bowel complaints have been for the last 10 years as follows:—

Years.	Deaths from Bowel Complaints.	Years.	Deaths from Bowel Complaints.
1872 - - -	33,664	1877 - - -	60,257
1873 - - -	26,249	1878 - - -	41,165
1874 - - -	26,990	1879 - - -	26,349
1875 - - -	33,650	1880 - - -	24,452
1876 - - -	33,683	1881 - - -	30,342

This abstract, like the preceding one, shows a great increase of bowel complaint deaths during the famine period. The death-rate for nine years to population, including the famine years in this abstract, averaged 2·10 per 1,000. In 1881 it was 1·84, and in 1882 it was 1·72 per 1,000. In the latter year 28,353 deaths were attributed to this cause.

The fact that bowel complaint deaths were registered in 271 circles of registration out of 286 shows a very general distribution of them. But out of 24,431 villages the whole mortality was returned from 5,646.

The deaths registered month by month in 1882 were as follows:—

Months.	Bowel Complaint Deaths.	Months.	Bowel Complaint Deaths.
January - -	2,128	July - - -	2,652
February - -	2,053	August - -	3,149
March - - -	2,011	September - -	2,916
April - - -	1,936	October - -	2,399
May - - -	2,302	November - -	2,298
June - - -	2,184	December - -	2,330

The average mortality for the rural circles was 1·69 per 1,000, and for the towns, all of which, with two exceptions, returned deaths under this head, the death-rate was 1·96 per 1,000.

28. *Injuries.*—Deaths from injuries during 1882 were as follows :—

Causes.	Deaths.	
	Males.	Females.
Drowning	1,255	1,387
Poisoning	58	45
Hanging	124	90
Wounding	249	112
Wild beasts	53	18
Snake-bites	847	430
Other causes	910	335
	3,496	2,417
Total	5,913	

The mean death-rate from injuries during nine years up to 1880 was 0·40 per 1,000 of the population. In 1881 the rate was 0·36 per 1,000, and it was the same in 1882. We would venture to call attention to two points in the abstract. The first of these is that 2,642 people were drowned, and that other reports have shown that most of these drownings, whether intentional or accidental, have taken place in tanks and wells for supplying domestic water, thus affording an argument for protecting all water sources from accidents of this kind. The other point is the large mortality from snake-bites, and the necessity it shows for greater activity in destroying venomous snakes. The mean annual number of deaths for five years, 1877 to 1881, from this cause, was 1,119, which had risen to 1,277 in 1881.

The following abstract of monthly deaths during 1882 shows the times of most danger to life from snakes, and also the times when there ought to be greater activity in their destruction :—

Months.	Snake-bite Deaths.	Months.	Snake-bite Deaths.
January	35	July	168
February	39	August	188
March	47	September	211
April	63	October	166
May	102	November	71
June	149	December	37

29. *All other causes.*—Deaths from all other causes amounted to 56,164, or 3·41 per 1,000 of the population. We have no information as to the causes of these deaths, but it is worthy of remark that the towns which ought to have the most efficient means of arriving at the truth return these unclassed deaths at 10·51 per 1,000, while for the rural circles the ratio is 2·37 per 1,000. Nevertheless, the high town rate may be due to better diagnosis. The mean annual deaths under *all other causes* for a period of nine years, 1872 to 1880, amounted to 70,935, but this mean included 238,426 deaths due to the great famine year 1877, to which we drew attention at the time, as marking a great deterioration of the public health, apart from the losses due to epidemics.

30. Under the head of *Sanitary Works* (*Military*), it is stated that Rs. 119,036 were spent at 22 stations in Bombay. The details for each station are given, but they require no notice further than that the works done belong to current repairs rather than to sanitary work properly so called; useful, no doubt, but not likely to benefit the general sanitary condition of the stations themselves.

31. *Sanitary Works* (*Civil*).—Under this head are given the population and expenditure of municipal and other towns in the province, arranged under each of the administrative divisions, of which the following abstract contains a summary :—

Division.	Number of Towns.	Population.	Annual Income.	Expenditure on Conservancy.
			Rs.	Rs.
Northern	34	613,908	899,816	213,905
Central	58	624,212	961,308	257,285
Southern	32	312,877	285,491	134,217
Sind	39	323,692	772,318	186,872
Total	163	1,874,689	2,919,433	722,280

These 163 towns, with a population of 1,874,689, and an income in round numbers of 291,943*l.*, spent 72,228*l.* on cleansing, or about 25 per cent. of their income, or about 15*d.* per head. But cleansing is not the only improvement carried out. In many of the towns in all the divisions surface drains have been or are being provided, generally of shallow section and impervious material, but they appear to be mainly laid down in public streets and thoroughfares, while in lanes and bye-ways cuts

in the earth are adopted. The result, of course, is that, while the external appearance of towns drained in this manner is improved, the more unhealthy parts of them are undrained. But, properly speaking, none of the towns are drained except into household cesspits, and wherever there are house wells the water in them is liable to pollution by sewage infiltration.

In a number of towns better water-supply has been provided by public wells, or by bringing in a filtered water-supply by means of reservoirs, filters, and pipes. In some cases water is distributed by means of hydrants in the streets. The important water-supply for Kurrachee was nearly completed. No large works were undertaken during the year, and although a plan for the drainage of Poona and applying the sewage for agriculture has been completed, the present Report gives us this information about it, that "the local distrust is such that nothing has been done."

Most of the towns appear to have proper markets, kept clean. Generally speaking, there has been much good surface work, apparently, done, and more attention is being paid to the surface drainage and water-supply; but the great work of purifying the subsoil by filling up all cesspits and closing house wells near them has yet to be done. These improvements imply either the introduction of permanent works of house and town drainage, or such structural alterations in the house compounds as will admit of the collection and removal of household sewage by hand labour. One instance is mentioned in which refuse water from houses in the bazaar at Kanara "is removed, at the cost of the owners, by means of iron receptacles placed in the rear of the houses, and they are emptied daily." This is one of the best substitutes for house drainage, but, under a proper town drainage system, a few feet of drain pipe to connect the house with the sewer outside would save the cost of the iron receptacle, its wear and tear, and the daily outlay for removal of its contents.

32. It is not easy to estimate what may have been the influence on the public health of this surface work, but if we could rely on the statistics, the results have not been without encouragement. For example, the general death-rate of the towns for five years preceding 1882 had been 35·82 per 1,000, while in 1882 the rate had fallen to 25·93 per 1,000. But on the other hand, there had been a similar reduction in the rural death-rate from 26·73 to 20·13 per 1,000. These country rates are manifestly incorrect, but the better town registration would apparently show a considerable saving of life.

33. *Local Fund Circles.*—These circles, situated in the different collectorates, receive small annual grants for local improvements, chiefly for conservancy and improved water-supply. The amount of work done by them is no doubt useful, but all that can be said about it is that the extent of it falls far short of the necessities. What appears to be wanted for these rural population groups is some executive authority to systematize the work and to render it thoroughly effectual, for it is known that the chief sanitary problems everywhere in India lie, not among municipal towns, but in country villages and within the compounds of their houses. We are glad to learn that steps have been already taken by the Government to deal with villages.

34. We have stated the sanitary improvements for the smaller class of municipal towns and for villages in our Suggestions for the Sanitary Improvement of Indian Stations and their vicinity (revised edition, 1882), and we must refer to these for particulars.

35. Under the head of general remarks are included a separate report by the Sanitary Commissioner on the Ghorpuri lines at Poona, a report on drainage for Poona city, or rather on the present substitutes in use instead of drainage, and an inspection report on Aden, and on water analysis, all of which we shall notice briefly before concluding our remarks on the present year's report.

36. *Ghorpuri lines.*—The case against these lines is tersely stated by the Sanitary Commissioner as follows:—"For some years these lines have been acquiring an increasing notoriety as very hotbeds of "malaria, and of late regiment after regiment has been so reduced in efficiency by admissions into "hospital from paroxysmal fever that abandonment of the site has been talked of."

There are two sets of barracks at Poona, viz., Ghorpuri lines and Wanowrie barracks, about a mile distant from each other, and the relative amount of paroxysmal fever in each set on a 11 years' average has been as follows:—

	Admissions per 1,000.
Ghorpuri - - - - -	652·09
Wanowrie - - - - -	324·85

The relative ratios during these years were—Wanowrie 1 to 2·01 in Ghorpuri.

The present report contains plans and sections of the ground occupied by both sets of lines, which show that the ground slopes between the two sets of lines, so that the barracks at Wanowrie are about 100 feet higher than those at Ghorpuri, but this in a line of above one mile would make no great difference in the drainage of the sites. The subsoil is essentially the same under each set of lines. There is solid trap rock 5 to 6 feet below the surface; over this is a layer of moorum, with a few inches of earth over all. A number of samples of moorum taken close to the barrack blocks showed on chemical analysis the presence of free ammonia, albuminoid ammonia, and chlorine, but the proportions were not notably greater in the moorum at Ghorpuri than in that taken at Wanowrie. Still, it must be admitted that the surface and subsoil to a certain depth showed more or less pollution by organic impurities.

Trial openings made in the ground showed no trace of unusual damp, but still the sites are not drained, and no provision had been made for draining away the used water-supply, which in the Ghorpuri lines amounts to between 17,000 and 18,000 gallons a day.

So far as can be judged of from the barrack plans, there is nothing in them to account for the large excess of malarial fever at Ghorpuri. But there is what appears to be an essential difference in the sites occupied by the two lines. To the windward of Ghorpuri lines during nearly six months there is a great area of wet cultivation, which comes to within 600 yards of the barracks. This area is nearly a mile distant from Wanowrie, and the wind blows over it towards Wanowrie for only 10 or 12 days in the year. The length of this irrigated area, as shown on the map, is about a mile, but its whole breadth is not shown, although the part shown in the map is about half a mile broad. Of all the causes which have been assigned for the Ghorpuri fever, this is the most probable, and it would also account for the prevalence of unwholesome fogs over the site. The new barracks appear to have been echeloned, so as to receive to the greatest advantage the malarial winds coming from this wet culture. It is possible that the local climate might be improved by drainage of the ground under cultivation, by regulating the wet culture, so that no more water should be applied than is absolutely necessary, and by planting a belt of trees between the ground and the barracks.

Since the report was drawn up we believe that the Government of India, as stated in our last year's memorandum, has decided to remove the troops from these lines by way of trial. If on their returning the fever re-appears, there would appear to be no resource left but to abandon the site, unless its unhealthy surroundings can be done away with.

37. *Drainage of Poona city.*—Under this head the Sanitary Commissioner discusses the drainage scheme for Poona proposed by Colonel Ducat, and endorsed by Sir Robert Rawlinson, in relation to certain statements made by the Secretary to the Municipal Committee on the supposed superior advantages of the dry-earth system of conservancy, and its adaptation to the manufacture of poudrette. This discussion, like all others of the kind, has two sides to it, and the question at issue is whether in a city like Poonah, with some 100,000 inhabitants, the dry-earth system is as effectual and economical as against the cost of permanent works as it might be made for a village or a military station. The dry-earth system is not under discussion, but the question is whether the municipal committee is well advised in trusting to it for protecting the health of so large a population.

The Sanitary Commissioner shows in his special report that the dry-earth system provides only for the removal in an imperfect way of most of the house sewage, including a certain amount of liquid which cannot be separated, but that the cleansing is by no means sufficient, while the water brought into the town for use is left to find its way to an outlet. "At present," says the Sanitary Commissioner, "some of this water finds its way into the river, and as liquid refuse it converts the stream "above the old city bridge into a pool of the foulest sewage. The greater portion, however, is "absorbed before it reaches the river, and adds very considerably to the generally polluted condition "of the soil and subsoil. Under a sewerage system all would eventually be changed. The filthy "discharges from bath-rooms and kitchens, and the still filthier ooze from privies would no longer "lie about to taint the air and endanger the water-supply, and the enforced supply of public latrines "and urinals would in time suppress those every-day practices which are as degrading as disgusting." And in the reply to the Secretary's opinion that the existing Poona system is the best, he asks, "Can "that system be 'by far the best' which leaves every day upwards of 100 tons of night-soil to pollute "the banks of the intersecting streams, to lie broadcast here, there, and everywhere, and form "sickening pools of fœtid ooze in side lanes and gutters?" We must accept this official statement as showing the general result here as everywhere else, even in our own home camps, of dealing with one element only in sanitary administration, and leaving all the others to themselves. We desire in no sense to undervalue the effect of thorough cleansing, by any system, on the public health, but it must be thorough. If the municipality chooses to adopt hand collection and hand removal of all town refuse, this must include the waste water, and the total prevention of such results of their present proceedings as the Sanitary Commissioner has described. The point of profit or economy dwelt on by the Secretary to the Committee does not primarily enter into the public health question. The first thing to see to is that the work be thoroughly done, and the second that it be done in the most economical manner. For a population of 100,000, it would be contrary to all experience that this Poona poudrette system should by itself remove all the local disease causes, and then we have the constant experience that removal of town and house sewage is most cheaply and effectually done by house drainage, and hence we must either accept the Poona practice as a remedy, which, in the face of facts stated by the Sanitary Commissioner, we decline to do, or the municipality must be prepared to collect and remove by hand labour all the house sewage not used for poudrette making, so as to abolish entirely the risk of its lying on the surface and draining into the subsoil, or they must adopt a general drainage system which will collect all the house sewage house by house, and convey it innocuously to an outlet, there to be applied for agricultural purposes at a distance.

38. *Report on Aden.*—This Report is mainly an abstract of facts regarding the sanitary condition of the station, but it calls pointed attention to the present and prospective condition of the water-supply and house cesspits. We have dealt with these points on former occasions, and there is little that can be urged on the subject that has not been said before.

Mr. Lumsdaine advises the substitution of drain pipes laid in the present unsatisfactory water channel for conveying water from Sheik Othman wells. This channel is built of bricks and stone slabs, but as it is carried partly across a marsh, and is liable to be submerged, there is every probability that infiltration takes place from without. The proposed remedy of laying earthenware pipes in the channel, with careful filling in with concrete, would prevent any injury to the supply, but, if there be sufficient pressure, small iron pipes would probably answer better. No analysis of the water is given.

The house-drainage question of Aden is one of great importance. At present the whole sewage appears to be passed into the subsoil, and a new settlement is in course of formation on the mainland,

where, unless great care is exercised in its sanitary arrangements, we shall have a plague spot in time. Considering the vast importance of Aden to commerce, and recent outbreaks of cholera there from neglect of very obvious precautions, we feel it incumbent on us to advise, as we have done before, that all cesspits should be cleared out and filled up, and proper conservancy introduced for the collection and removal of all house sewage. It is a somewhat curious comment on our sanitary administration at Aden, that a Frenchman finds it pay him to purchase the burnt surface sweepings, screen them, and export them to France.

39. *Water analysis.*—Under this head are given the results of examinations of three river samples, seven from Tulsi reservoir, and three from Vehar reservoir, Bombay, and 39 well waters. Nine of the samples were taken at Nasik, 31 at Baroda, one at Mount Abu, and the Tulsi and Vehar samples at Bombay. The results of some of the examinations are interesting and important. The Tulsi samples taken from the surface and middle strata of water gave from 4·2 to 7·7 grains of solids per gallon, of which chlorine averaged about one grain only per gallon. One sample taken from the bottom of the lake yielded 11·9 grains of solids, but still the chlorine was only 1·05 grains per gallon. The ammoniacal products increased to a certain extent near the bottom of the lake, but almost disappeared in the distribution pipes. The constitution of the Vehar water was essentially the same. Seeing that both reservoirs are at no great distance from the ocean, the amount of chlorine is not large, and the ammoniacal products are no doubt of vegetable origin, as all the samples showed vegetable débris and infusoria under the microscope. Both waters are otherwise remarkably pure, but the microscopic and analytical results point to the necessity we long since showed to exist for filtering the supply before distribution. Were this done, Bombay would vie with any town in existence in the purity of its water-supply.

The river samples taken from the Godavari, near Nasik, are not so pure as the Bombay water. They contain from 20 to 22 grains of solids, but the chlorine is little more than a grain and a half per gallon. The ammoniacal products are small in amount and apparently of vegetable origin. As this water contains vegetable débris and infusoria it would be improved by filtration.

The well samples for the most part have a very different history. With few exceptions they could only be used with great risk to health, and some of them are quite unfit for any domestic purpose. One sample taken from a well at the old bakery, Baroda, yielded 166·6 grains of solid matter per gallon, of which 39·9 grains were chlorine. With two or three exceptions these wells bear distinct evidence of sewage pollution. There is one sample from Mount Abu which appears to have been as pure as the Bombay supply, but it was taken from a new well, thereby showing the source of impurities in the older well waters.

The argument from this table is irresistably in favour of providing new well supplies and taking steps for protecting the wells from subsoil infiltration in the manner pointed out in our suggestions.

40. In conclusion, the practical sanitary teaching of this Report on Bombay Presidency for 1882 appears to point to the necessity of proceeding rapidly with the improvement of towns and villages,—(first), and before all, in cleansing and keeping clean not only the visible surface, but the house compounds; (second) provision of better water and better protection of the water sources, when obtained, in the manner pointed out in our suggestions; (third) the improvement of drainage of village sites and surface drainage by shallow impervious drains. We have shown this method also in our suggestions, which likewise contain the general principles on which village work should be done; (fourthly) the evidence in the Poona Report shows the necessity of proceeding without delay to carry out an efficient drainage scheme for that city.

Lastly, there is evidence in the present Report that, even making allowance for defective registration, the sanitary work already done, especially in Bombay City, has saved life, and has thus afforded an example of sanitary improvement and its results, which might be attained in their degree in every population group in the Presidency, if it were only determined that this work should henceforth be done.

APPENDIX to REPORT of the SANITARY COMMISSIONER, BOMBAY.

The Sanitary Condition of Nusseerabad, Neemuch, and Mhow.

For a number of years past these three stations have attracted attention on account of their unhealthiness for British troops, and more especially from the prevalence of fatal forms of fever. They have all been examined and reported on, but as there were differences of opinion on some points of their history, Mr. Hewlett was directed by the Government to make a special technical examination of them, the result of which is given in a separate report on each station. The reports are appended to that of the Sanitary Commissioner of Bombay Presidency, and we propose briefly to state their results, beginning with:—

1. NUSSEERABAD.

The fundamental facts bearing on the disease history of Nusseerabad may be stated as follows:—

The strength of troops on a ten years' annual average has been 636.

The 10 years' average admission-rate has been 1,897·5 per 1,000, while for the whole Indian army the rate was 1,474·8 per 1,000.

The 10 years' average death-rate was for Nusseerabad 23·73 per 1,000, and for the whole Indian army 19·34 per 1,000.

Of this death-rate 4·24 per 1,000 was caused by enteric fever at Nusseerabad, against a death-rate for the whole Indian army from the same fever of 2·03 per 1,000.

The death-rate from other fatal fevers (intermittent, remittent, and continued) at Nusseerabad was 2·67 per 1,000, and for the whole Indian army 1·42 per 1,000. Cholera has been less fatal at Nusseerabad than the average for the whole Indian army, in the proportion of 2·04 per 1,000 to 3·22 per 1,000.

Apoplexy, dysentery, diarrhœa, and hepatitis are slightly more fatal at Nusseerabad than in the army generally, but the higher rate at Nusseerabad in times past has been essentially due to fevers, as will be seen from the fact that, if the fever death-rate at this station were no higher than the corresponding rate for the Indian army, the Nusseerabad 10 years' death-rate would have been 20·37 per 1,000 against 19·34 for the whole army, while a death-rate of 1 per 1,000 taken from the Indian army cholera rate would have restored the balance.

2. The Nusseerabad inquiry carried out by Mr. Hewlett had for its object the elucidation of the causes of fever mortality there, and the first important result of his investigation is that during the 10 years ending 1881 there had been 43 admissions and 30 deaths from enteric fever; that of these numbers three admissions and two deaths had taken place among a calculated strength of 141 men in the Artillery, while 41 admissions and 28 deaths had taken place among 481 men of the Infantry, giving for the former arm an admission-rate of 2·13, and for the latter of 8·32 per 1,000. The Artillery death-rate was 1·41 per 1,000, and that of the Infantry 5·8 per 1,000.

3. As regards age. Out of the 30 deaths 20 had taken place under 25 years, and the remaining 10 in years up to 32, beyond which no enteric fever deaths had occurred.

As related to season. No deaths had taken place before April, but out of 30 deaths 22 had taken place during the last four months of these years.

4. We shall next abstract the 10 years fever-rates, 1870–79, together with the monthly temperatures and rainfall, in order to show the relation of monthly climatic elements to the fever statistics.

Months.	Aggregate Fever-rates for Ten Years, 1870–79.				Monthly Mean Temperature.	Monthly Mean Rainfall.
	Enteric Fever.		Other Fevers.			
	Admitted.	Died.	Admitted.	Died.		
					°	Inches.
January	2	1	255	5	58·9	0·5
February	—	—	236	—	70·0	—
March	1	—	251	4	72·1	0·28
April	2	2	311	1	85·3	0·08
May	3	1	366	—	93·8	0·25
June	—	—	318	1	91·7	3·45
July	—	—	388	1	85·4	7·65
August	5	3	368	1	83·6	4·69
September	11	10	365	4	83·8	3·89
October	3	2	391	2	80·6	0·25
November	5	6	542	1	73·8	0·01
December	5	2	225	—	65·4	—
Total	40	27	5,264	17	78·2	21·06

Of the total other fevers in this table, amounting to 5,264 admissions and 17 deaths, it may be stated that 518 admissions and 13 deaths are entered under the designation of remittent and continued fevers, and it follows that out of 44 deaths from fever, 40, or above nine-tenths, were due to the severer types (enteric, remittent, and continued).

The monthly climatic elements show that the first five months the temperature rises rapidly, and attains the very high monthly mean of 93·8°, the maximum of the year, in May, but that during the same five five months the rainfall is so trivial as scarcely to call for notice. The active climatic element is rapid rise in temperature and no doubt considerable temperature range, for the difference between the highest and lowest monthly mean of the year is 34·9°. During these five months there were recorded four deaths from enteric fever and seven deaths from the severer types of remittent and continued fevers. The monsoon bursts out in June, and all the rain likely to influence disease causes falls in June, July, August, and September, the average fall in these months being 19·68 inches out of a total annual fall of 21·06 inches. It was during this monsoon rain that deaths from intermittent fever were registered, four in number in all, and it is during and after the rain that the fever deaths mostly take place, so that while during the first six months of the year 12 fever deaths represented the total 10 years' mortality, the last six months yielded 32 fever deaths, of which 23 were due to enteric fever, four to intermittent, and five to remittent and continued fevers. The monsoon and subsequent drying up of rain was hence attended by 28 deaths from the more severe fever types, or 70 per cent. of these deaths.

The question raised by these facts is whether rainfall and temperature by themselves could by any possibility have occasioned such results, and the answer must be in the negative. There must be some other cause or causes let loose by the rain, and that what is called malaria is one of these is

proved by the great increase of intermittent fever as well as of the severer types after the rains have set in. But as we have no proof that the severer fever types are due to malaria and to nothing else we must endeavour to find the causes elsewhere, if any such exist.

6. As regards topography, the cantonment of Nusseerabad occupies a site between 1,407 and 1,470 feet above the sea. It is situated on an open sandy plain sloping to the south, at a distance of 3½ miles from the nearest point of the Aravalli hills. The country between the cantonment and the hills drains down into a nullah about half a mile to the west, which has been embanked in its course. And similar embankments are used to form irrigation tanks by villages in the neighbourhood. The subsoil consists of micaceous or hornblende schists, which are very likely to retain rain-water in any hollows found in them. The account given of the locality in the Nusseerabad Report by the Royal Commissioners on the sanitary state of the Indian Army is as follows: "The geological structure of "the district belongs chiefly to the metamorphic group of rocks. The substratum consists for the "most part of transition gneiss, reached at a depth of a few inches in many places, while here and "there the bare rock appears. In some situations the soil is many feet in thickness. It is formed "of disintegrated rock, chiefly decomposed felspar (one of its constituents), producing a clay of "considerable fertility and moisture. During the dry season water is found from 10 to 50 or 60 feet "below the surface, according to situation, and, as a general rule, at the same depth in the rainy "season."

These topographical facts would apparently imply that the sub-surface rocky formation is irregular, and contains rocky hollows which are not self-draining, the whole being filled with disintegrated rock to a greater or less depth, and thus forming one of the apparently anomalous cases in which the effects of malaria are produced, where there are no apparently marshy conditions. But, besides this, Mr. Hewlett states that there is a good deal of sub-marshy ground to be found at the south-west of the camp after the rains, and there are several favourite snipe grounds within six or seven miles. It should be stated in connexion with this sub-marshy ground that the wind directions show a very considerable prevalence of winds between west and south during the fever months.

7. We have so frequently discussed the water-supply of Nusseerabad that there is little more to be said about it. The whole question appears to be in a somewhat confused state. An impounding reservoir has been formed between rocky hills, and the whole area is carefully protected from fouling. The water is, moreover, laid on to the cantonment, and is not found to be fit for drinking. On the other hand, the water of a public well belonging to a village, Dilwarra, and exposed to the usual sources of impurity in drawing and transport, is used for drinking after filtration. Why is this so? Mr. Hewlett says that the Danta reservoir water is the better water. Danta samples yielded 20 grains per gallon of total solids, of which 7 grains were chlorine. The free ammonia is ·0132 per million, and the albuminoid ammonia ·32 per million. The water shows copious vegetable *débris* with infusorial life. But the analyst very properly points out that the impurity is all of vegetable origin. The rocks of the gathering ground yield all the chlorides. The Dilwarra well yields 42 grains of solid matter per gallon, of which 6·73 grains are chlorine, while it is by no means clear that in this well the chlorine is also of mineral origin. The ammonia is precisely the same in amount as in the Danta water, and the albuminoid ammonia is 0·7 per million.

The chief objection to the Danta water is its taste when drawn, but as the gathering ground is covered with decaying vegetation, especially with euphorbia bushes, the impurities are, in all probability, due to this cause. We agree with Mr. Hewlett in advising the clearing at once, and periodically, of the surface from these bushes, but if any wholesome low vegetation, such as grass, would grow on the surface, it would afford the best protection from vegetable organic impurities. The water should be carefully filtered before use, and received into covered tanks.

8. The sub-surface configuration, already mentioned, points to a probable source of well water impurity where sewage is allowed to pass into the subsoil, because the porous character of the soil will allow sewage from cesspits, as well as rain, to sink into hollows where such exist in the underlying rocks. This is apparently the case, as there are water samples taken from wells near the station, showing an extraordinary amount of impurities. As much as 70 grains of solids per gallon to upwards of 143 grains per gallon, of which, from 15 to 51 grains per gallon are chlorine, are shown by the analyses in the report. Samples of aerated waters sold to the men are described, in which the contained chlorine amounted to 9½ grains and 20·8 grains per gallon. As a general deduction from the facts, it may be stated that there is little chance of men obtaining water fit to drink outside the limits of the station.

9. There has been considerable diversity of opinion on the question of drainage at Nusseerabad, which may be partly due to the time and place where the surface, after rain, had been observed. Where the underlying rock comes near the surface, the probability is that water would disappear more slowly than if there were an underlying hollow.

One medical officer, for example, says: "The drainage is very imperfect, and not sufficient to carry "off half the water which falls during the monsoon season; consequently, what remains, lodges, and "possibly is injurious to health." Another medical officer states that "the ground in the immediate "vicinity of the barracks is in many places so level as to render thorough surface drainage impracticable . . . . there must be great difficulty in keeping the surface clean during the wet season, more "especially as the surface drains are merely trenches in the ground, and not pucca built." On the other hand, this view is not held by the executive engineer, so far as concerns the sufficiency of surface drainage, but in a letter of his, much additional light is thrown on the whole drainage question, as follows:— "The depth of what may be called soil or earth overlying the natural rock formation, does not "exceed 7 feet anywhere. Over much of the area it is only from 1 foot to 3 feet deep. Of this,

" from 6 inches to 2 feet is composed of drift sand, mixed with clay and vegetable matter; below " this, the soil is that which results from the decomposition of felspathic rocks, and so on, down to " the harder rock. Until rock is reached, the soil may be called more or less porous, and during " continuous rain it does, no doubt, absorb and hold up water as would a sponge. It is quite " possible, I think, that as this upper layer gradually dries up after the rains, damp air may arise; " and if such air, rising from such a soil, is hurtful, the condition may be insanitary."

"The above remarks point, I would suggest, rather to the necessity of some system of subsoil drainage than to a want of surface drainage."

There is no system of house drainage for the barracks. At present the stable drainage sinks into the ground, and the fluid barrack refuse is collected and carried away to be thrown on the surface for trees, &c.

The dry earth system of conservancy is in use.

10. Keeping in mind this official statement as to the site itself, we shall consider it in relation to the barrack accommodation.

It appears that there has been a cantonment on this site since 1818, and there is a map in the report, showing what was the arrangement of building in 1821, and we learn from it that "the " barracks of the European infantry are on the site of the lines formerly occupied by a native " regiment, and the artillery occupy the site of the old artillery lines. . . . . The patcherries " of the European infantry have been built partly across the horse lines of the native cavalry regi- " ment," and partly on the site of old huts.

So that we have at Nusseerabad to deal not only with the special surface and sub-surface topography of the site, but with the additional circumstance that the site is an old one, formerly occupied by native troops, the occupation of which Mr. Hewlett considers to have involved "a mistake of the most fatal nature," which might have been avoided by altering the alignment of buildings, and ploughing up and cultivating the old site. And to these defects of site have to be added another, namely, that in none of the barracks has any provision been made for ensuring a current of air between the ground surface and the barrack floors.

11. In the absence of personal local examination, we must take the facts as they have been presented by this special inquiry, and these appear to include all the main reasons of the special unhealthiness and fever prevalence at this station.

Mr. Hewlett sums up the case in these words: "Looking at the station as a whole, its barracks, " hospitals, the state of the surface and subsoil drainage during and after the rains, its water-supply, " its bazaar, and particularly the time it has existed, whether it is a station to which I should feel " disposed to send troops predisposed to enteric fever, and I am forced to the opinion that, taking all " these points into consideration, it most certainly is not."

12. The bazaar alluded to in this extract presents the features of the station itself in an aggravated degree, and there can be no doubt that the soldier's health will be risked just in proportion to the time he spends in this and similar places. It hence follows that improvements at Nusseerabad must include improvements in drainage, water-supply, cleansing, removal of cattle (there are 4,570 animals kept in the Sadar bazaar), and similar measures among the native population.

13. And then arises the question of station improvement itself, in reference to which we would state as follows:—

(1.) When the site was first chosen the importance of the geological configuration and subsoil to the healthiness of buildings erected over it was unknown. Hence, if the cantonment is to be occupied by European troops in future, the influence of the site itself must be taken as a fixed quantity, which may be modified but not changed.

(2.) The risks inherent in the sub-surface are those resulting from the retention of rainfall or drainage in hollows at no great depth below the surface, which water is shown by the well analyses to be largely contaminated with organic matter, the per-centage of which has a tendency to increase by evaporation.

(3.) These risks would not have been so great as they are if the European lines had been laid out on new ground instead of old occupied ground.

(4.) The old site requires to be subsoil drained, to remove as much of the rainfall as possible to a distance.

(5.) The present practice of throwing foul water over the surface should be discontinued, and a drainage system adopted for conveying away to a safe distance all lavatory and bath water, kitchen water, urine, all horse drainage of European and native lines, and for applying it to agriculture. None of this should on any account be allowed to enter the subsoil.

(6.) The dry-earth system, carefully worked, would answer for latrines, but the question would arise whether the same drains which removed the foul water might not be used for removing the latrine sewage.

(7.) The whole water-supply system needs to be reviewed. If the Danta reservoir gathering ground be cleansed of unwholesome vegetation, and kept clear, it ought, with or without additional surface area, to yield perfectly good water, and this ought to be filtered at the station, and carefully protected thereafter.

(8.) As regards the barracks, if these are to be improved, so as reduce the risk of malaria as far as possible, then their floors must have a free perflation of air between them and the ground. Probably a floor raised above the present one would answer best.

(9.) The proposal in the report to plough up the ground of the station and crop it, would be useful, and the area should be covered with grass, or with other low growing vegetation.

2. Neemuch.

14. We shall abstract the statistical data bearing on the health of European troops at Neemuch from Dr. Stevens' tables, and, as will be seen, the sanitary problems presented by this station differ somewhat from those of Nusseerabad. We shall use the same comparison with the army as a whole, and with the following results.

15. At Neemuch the average strength of European troops during 10 years, 1870–79, was 426, and the 10 years' average admission-rate from all causes was 2,242·5 per 1,000, while in the Indian European army, as a whole, the rate was 1,474·8 per 1,000. The 10 years' average death-rate for Neemuch was 29·11 per 1,000, and for the whole Indian army, 19·34 per 1,000.

Of the very high Neemuch death-rate, no less than 12·91 per 1,000 was due to cholera, showing that Neemuch has in times past been one of the chief cholera stations for European troops. For the whole Indian army the cholera death-rate in the same 10 years was 3·22 per 1,000, or less than a quarter of the Neemuch rate. This station has been infested with fatal fevers also, and has yielded a death-rate of 3·75 from enteric fever, while for the whole army the enteric fever-rate has averaged 2·03 per 1,000. Other fatal fevers have yielded a rate of 2·11 per 1,000 at Neemuch, against 1·42 per 1,000 for the whole army.

The local sanitary problem, so far as fatal epidemic diseases are concerned, may be summed up in the following question:—How happens it that the aggregate death-rate from cholera and fevers at Neemuch has been 18·77 per 1,000, while for the whole European army in India it has been 6·67 per 1,000? The total death-rate at Neemuch exceeds the total death-rate of the whole European Indian army by 9·77 per 1,000, and its cholera and fever-rate exceeds the army rate by 12·10 per 1,000. The death-rate from apoplexy at Neemuch has been 2·35 per 1,000 against 1·52 for the whole army. But the excesses at Neemuch are essentially due to epidemics, and we must now see whether any light is thrown on their causes by Mr. Hewlett's inquiry.

16. The first fact of importance in this investigation is a very remarkable one, and this is the great prevalence of malarial admissions at Neemuch as contrasted with the corresponding facts for the whole Indian army. The facts are as follow:—

Fevers.	Admissions per 1,000.	
	Neemuch.	Army of India.
Intermittent	1,058·0	389·4
Remittent and continued	247·7	162·2
Enteric	5·4	4·6
Total	1,311·1	556·2

Neemuch, as shown by this contrast, is not only an epidemic station, but it is a hotbed of malaria. The facts taken as a whole lead to the conclusion that Neemuch must take a high rank among the unhealthy stations in India, and yet it has been stated that in former times Neemuch was a healthy station, and, as such, was resorted to for change from other stations.

17. We shall next give such elements of climate as may enable us to form some estimate of the influence of local climate on health, and for this purpose we shall select the latest completed year in the tables, viz., 1881, and the ten years' fever admissions, 1870 to 1879.

Months.	Aggregate of Fever Admission, 1870 to 1879.	Temperature Means.			Temperature Extremes.			Humidity, 16 Hours' Mean.	Rainfall.
		Mean Max.	Mean Min.	Mean Range.	Highest Reading.	Lowest Reading.	Absolute Range.		
									Inches.
January	173	78·2	48·5	29·7	88·6	39·7	42·9	28	—
February	105	84·6	56·2	28·4	89·5	49·8	39·7	29	0·59
March	111	88·6	58·5	30·1	99·1	45·5	53·6	23	0·18
April	219	99·2	70·8	28·4	108·3	63·8	44·5	18	—
May	245	106·1	76·8	29·3	118·5	63·7	49·8	17	0·20
June	258	98·4	77·3	21·0	104·6	69·9	34·7	40	3·72
July	289	84·4	73·5	10·9	105·7	71·7	34·0	80	15·87
August	501	83·8	72·7	11·1	86·2	70·5	15·4	74	10·63
September	1,064	86·8	70·9	15·9	93·0	66·6	26·4	61	2·92
October	1,234	90·4	65·3	25·1	93·8	59·6	34·2	34	—
November	885	83·3	58·4	29·9	89·1	45·9	43·2	25	—
December	510	79·2	50·2	28·9	84·8	45·9	38·9	20	0·97

This abstract shows that high temperature by itself, or high temperature ranges with air dryness, do not augment fever prevalence at Neemuch. But an immediate increase of fever attends rain and increase of humidity, where the temperature ranges are not excessive. The great rise in fever admissions accompanies the cessation of rain, and attendant increase of temperature range, and of evaporation.

To this abstract it may be added that the highest solar radiation varied between 148·7° in January, and 174·2° in May. The excess of sun heat over night radiation appears to be about 100° to 120°, according to season. Neemuch is a climate with considerable extremes, and the effect of these extremes on liability to recurrence of fever can scarcely be doubted.

Temperature and humidity are both subject to large oscillations, and seeing that the tabular data are monthly averages, the daily variations must be much greater. Anyway, we cannot alter climate. What the data indicate by way of precaution are, care in clothing and exposure, especially when on night duty, avoiding throwing off garments in the heat, without considering rapid fall in temperature which may be at hand, and regulation of barrack-room ventilation, so as to avoid drafts. The great sun radiation may lead to prevalence of apoplexy, unless the head and spinal column be suitably protected, and alcoholic drinks avoided.

18. The next matter for discussion is the local topography of Neemuch. The cantonment is situated on an area of about half a square mile of surface, the northern end of which is 1,634 feet above sea level, and the southern end about 1,543 feet above the same datum. The underlying rock is trap, covered to various depths by red laterite, with underlying moorum or black cotton soil. The surface around cantonments is undulating, and contains numerous villages. The trap sub-surface appears to be of irregular formation, and holds water at from 6 to 9 feet beneath the surface. In other parts the depth varies from 10 to 40 feet. In some places, after rain, water remains in hollows below the surface level. Mr. Hewlett says that for many miles outside cantonment limits, from south-west to north of the European barracks, "there is an area of depression which, during and "after the rains, is very nearly water-logged and marshy. The black cotton soil, of which it for the "most part consists, is especially retentive of moisture, and the prevailing breeze, during and after "the rains, passes over the ground, and its full force is felt in the barracks."

The plateau itself is well situated for surface drainage, except on the north, but Mr. Hewlett says that, although there are sufficient facilities for storm water flowing away from the surface, "this does "not affect that which is absorbed into the subsoil, which is consequently but slowly drained, a "process which takes many months before the ground level lower than the bottom level of the surface "nala is dry."

Together with this condition of the subsoil must be taken into account the subsoil temperatures and soil moisture, of which a number of measurements are given, with the results that, during the rains, the subsoil contains between 45 to 50 or more grains of moisture per ounce weight, with a sub-soil temperature of from 75° to 90°, according to season.

19. The cantonment plan shows several watercourses at no great distance from the barracks, besides a large artificial tank, 1,400 feet long by 700 feet broad, which has been formed by pounding back the water of two nalas by an embankment. "The earthern dam not being water-tight, consequently "a not inconsiderable amount of leakage takes place, and the soil over a large area below the dam "is, during the monsoon season, marshy, and remains so for months after it, a slow ooze taking place "through the dam."

The distance of this tank is about 2,000 feet from the barracks, but even there, although the water level is 15 feet below the hospital floor, it backwaters the subsoil, and "consequently, prevents its "ready escape, and thus tends to keep the ground near the barracks damp. The ground below the "tank is distinctly a malaria-producing source," and it lies to windward of the lines. We have here, then, elements of climate, topography, and subsoil configuration, all of a malarial character, while the evils have been increased by backwatering, and nothing has been done in the way of drainage works to remedy the natural defects of locality. Moreover, if the tank dam has, in the course of time, become leaky, so as to produce this marshy condition of the ground below it, we should have a not improbable reason for the increased unhealthiness of the station.

20. *Water-supply.*—There are 206 wells in cantonments, of which 27 are in the bazaar, 104 are private property, and 102 are public property. A table is given of the data for 44 of these wells in the military lines, and it may throw some light on the subsoil drainage question to quote two examples from this table.

The Soldiers' garden well.—This well has a depth below the ground surface of 35 feet. In June there is 3 feet of water in this well. Then comes the rain, and next month, July, there are 5½ feet of water. In August, 24½ feet; in September, 28½ feet, which is the maximum depth, and then it falls till next rainy season. It will be observed that, as indicated by the water-level, the subsoil water which was 32 feet below the surface in June had risen to within 6½ feet in September. It need scarcely be pointed out that a rise such as this, experience indicates, must have important consequences on the local climate. Take another case, which appears to show the influence of water-logged subsoil. It is the *Hospital filter well*, from which the troops are supplied. Its depth is 45½ feet below the surface level. In July there are 25 feet of water in it, which would bring the water level to within 20½ feet of the surface. This is the lowest level attained by the water. But in September, under the action of the rains, this well has 43 feet of water, and, as will be seen, the level comes within 2½ feet of the ground surface. As the Leora tank, to which we have referred, has a surface level of about 15 feet below the hospital, it appears not unlikely that it influences the subsoil water level in the well, although at a distance of above 1,800 feet. Generally speaking, the water from wells within the lines is of fair quality, and that from the Hospital filter well contains 34·3 grains of solids per gallon, of which 2·2 are chlorine. The free ammonia is ·002, and the albuminoid ammonia is ·05 parts per million. It contains a little microscopic vegetable debris with monads. Very different, however, is the case with the outside native wells, some of which afford water little better than sewage. To show the risks arising from native carelessness, Mr. Hewlett says that he saw cow-dung

from a Bhisti's bullock among the sand used for filtering the hospital well water. Some analyses of water from this well, which had been carried in mussacks, show that while the total solids and chlorine remained the same, the ammoniacal impurities were greatly increased, and that the water contained large numbers of infusoria, including nematoid worms. There is one well to which Mr. Hewlett calls attention, because it is the only one to which a domed cover has been added, and the water drawn by an iron bucket and chain. It contains the same solid contents as the hospital well, namely, 34·3 grains per gallon, but the chlorine amounts to 1·96 grains only. There is no free ammonia, and the albuminoid ammonia is 0·4 parts per million, with a little débris and a few infusoria. It is the only instance of a well which has been improved in accordance with our Suggestions, except that it has not been cased outside with concrete.

The water-supply is apt to fail in dry years, and any means for keeping up the water level in wells would involve the raising of the subsoil water level of the station. What appears to be really required is the measure proposed by the executive engineer, namely, "a judicious selection of "localities for a few new wells that could be sunk free of the trap to a considerable depth, which "would ensure a fair supply. The water might be raised by steam-power to a permanent reservoir at "a sufficient height to allow of service distribution to upper stories by gravitation;" and we would add, every obstruction to the complete drainage of the station, such as the tank and similar impedi-ments, ought to be removed.

21. *Conservancy.*—Mr. Hewlett states that "the most scrupulous care is taken to preserve cleanliness in every detail." The latrines are well attended to, but some improvement appears to be required in disposing of the sewage, which is apt at present to cause nuisance in certain states of the wind. There is no house drainage, and all waste water from baths, lavatories, cook-houses, &c., has to be removed by hand to a distance.

22. *Barracks.*—Mr. Hewlett states, in regard to the accommodation for troops, as follows:—"The "barracks have been built on what I consider perhaps the worst site in the whole cantonment. . . "In the first place the radical error has been committed of placing them on the very confines "of cantonment limits. The jurisdiction of the officer commanding ceases within a few hundred "yards on the north and west sides, and in the case of Neemuch this error is aggravated, as the "country beyond the limits belongs to a native State where no sanitary measures are enforced, and "where every one of the many villages in the immediate neighbourhood of the cantonment may be "justly described as a centre of disease.

"The country, for miles from the south-west round to north, is an area of depression, consisting "principally of black cotton soil, and this is nearly water-logged during the monsoon, so that when "the rains cease and the water level begins to sink, the temperature being still high, malaria is "generated and the air passing over this extensive area at night becomes cold and chill, and is carried "by the prevailing breeze straight into the barracks. The barracks themselves are not water-tight, "and the men live in rooms with damp walls." There appears to be no current of air passed between the barrack floors and the ground surface.

23. The Sadar bazaar contains 2,085 houses and probably 13,000 or 14,000 inhabitants; much useful work has been done in the way of improving the sanitary state of the bazaar, but, on the other hand, it contained, besides its inhabitants, 2,052 animals.

24. Considering the facts as a whole which Mr. Hewlett has stated, there is little doubt as to the reasons why Neemuch has suffered so much from excessive and increased prevalence of epidemics.

In the first instance, a most unfortunate selection of a site for European troops was made. The local topography and subsoil both show that the site is essentially a fever generating one, both as regards topography and local climate, and that no attempt had been made to lessen its disadvantages in these respects by suitable local drainage works. It is further shown that the local disadvantages have been increased by mistaken measures for increasing the water-supply by the bunding of ravines, whereby the subsoil water-level has been raised and a considerable area of marshy ground added to that already existing.

Mr. Hewlett justly remarks that it is a difficult matter to suggest practicable remedies for the present evils. Probably the least costly, and, at the same time, the most effectual, would be the remedy said to be entertained by the Army Organization Committee, namely, to withdraw British troops from Neemuch, which he says he is sure "would be the best course to adopt." The force is not a large one, and yet if it is to be retained at Neemuch, certain works of a most costly nature, and far beyond the probable local value of the station, would have to be carried out. These are complete drainage of the country, not only in its surface, but in all the localities where water lodges and dries up.

This would include drainage of the cantonment itself, the abolition of the Leora tank and the thorough drainage of its site and vicinity. In short, efficient works would have to be carried out to keep down the subsoil water level and to drain subsoil hollows.

This needful drainage work would necessitate an independent water-supply as proposed by the executive engineer. These are the chief measures indicated as necessary by the disease history of the station, including, of course, improvements in barracks to remove dampness from the walls, and raising the floors, together with house drainage of the barrack blocks and subsidiary buildings. It is not for us to decide whether the place is worth all this trouble and outlay; what we have to do is to point out the remedies required if the station must be held by European troops.

3. Mhow.

25. The cantonment of Mhow is about 2,000 feet above sea level. It covers an area of six square miles and is surrounded by territory, including several unhealthy villages over which there is no cantonment jurisdiction. Its annual occupation by troops on a ten years' average, 1870-79, has been 1,327, Infantry, Artillery, and Cavalry. Within the cantonment, and midway between the European lines on the south and the native lines on the north, lies the bazaar, having a population on the census of 1872 of 17,640, besides 8,602 animals of various kinds which have no stables, but "are tethered inside and outside the houses and all their stale sinks into the ground."

The subsoil consists of a few inches of earth resting on three or four feet of moorum, which is underlaid by rock. The general contour of the ground is formed of ridges sloping down to water-courses, and the natural means of drainage appear to be ample; but ground of this class requires its drainage facilities to be made use of, otherwise water may gather in the subsoil of hollows and generate malaria, and this appears to be the case in several localities near the barracks of European troops. There is a series of interesting diagrams given in the report to show the relation of subsoil damp to the different cavalry barracks, the general result of which is that, during September, water is found at a few feet only below the surface. Similar trial wells might be advantageously dug in many Indian cantonments, and they might enable us to trace the origin of malarial fevers close to or even under the unventilated floors of barrack rooms. In the present case, Mr. Hewlett says that the "ground floors of all the barracks (Cavalry) were found to be more or less damp, especially in the "mess-room of No. 3 barrack, which presented the appearance of having been recently washed down, "although it had not been so for a week previously." These details will be sufficient to illustrate the general question of site, and we shall next state briefly what has been the past disease history of this station.

26. Mhow can scarcely be classed as an epidemic station, and although not altogether what may be called a healthy station, it by no means ranks so low in the scale as other stations in Bombay Presidency. Its death-rate from all causes, on a ten years' average, has been 11·68 per 1,000, a rate which compares very favourably with 19·34 per 1,000, which ruled in the whole Indian European army during the same ten years. Tried by its admission-rate, however, the results have not been so satisfactory. This rate has amounted to 1,695·5, while that of the Indian army has been 1,474·8 per 1,000. Of the total admissions at Mhow, 787·2 per 1,000 have been due to fevers, while for the whole Indian army the fever-rate had been 556·2 per 1,000. It follows that the higher rate at Mhow was due solely to the greater prevalence of fevers. Mhow must therefore be ranked among the Bombay fever stations. But a further analysis of the figures shows that the excess of fever prevalence at Mhow is due solely to intermittent fever, which yielded 701·9 per 1,000 at Mhow, against 389·4 per 1,000 for the whole army. Here again, the admissions from malarial fever at Mhow make up far more than the total excess of admissions at this station over the total admission-rate of the Indian army. As regards the other fevers, remittent and continued fevers have been less prevalent in Mhow than in the army generally, in the ratio 81·8 per 1,000 to 162·2 per 1,000; and enteric fever admissions have been also fewer, the Mhow rate having been 3·5 per 1,000 and the army rate 4·6 per 1,000. While comparing these admission-rates, it is necessary to call attention to the fact that the varying element of venereal disease has no influence in the comparison, because the rate at Mhow, 205 per 1,000, does not differ materially from the army ratio of 203·5 per 1,000. The fever death-rates for Mhow have been, enteric fever 1·96 per 1,000, and for other fevers 1·13 per 1,000. For the army of India the enteric fever death-rate has been 2·03 per 1,000, and other fevers 1·42 per 1,000. The total loss from fevers has thus been 3·09 per 1,000 at Mhow against 3·45 per 1,000 for the army as a whole. As regards one epidemic, cholera, this station has yielded an average death-rate of ·75 per 1,000, or less than a quarter of the cholera mortality of the army, which was 3·22 per 1,000. Dysentery and hepatitis have been also less fatal at Mhow.

It is unnecessary to pursue the disease history further, and what we have to account for and remedy as far as practicable is the amount of intermittent and other fevers at Mhow. But Mr. Hewlett has introduced a series of interesting comparisons, showing the disease prevalence at other Bombay stations, which will be found useful in differentiating the disease causes in each station.

We have at present to deal only with the broad facts of the case.

27. We shall first place, side by side, the temperatures, rainfall, and fever admissions month by month.

Months.	Aggregate Fever Admission, 10 years.	Mean Temperature.	Rainfall.
		°	Inches.
January	382	66·3	0·12
February	355	71·2	0·26
March	398	77·7	0·29
April	487	85·1	0·12
May	543	86·9	0·82
June	448	79·7	3·69
July	575	77·1	6·38
August	1,374	75·7	7·56
September	2,217	76·2	7·11
October	2,074	77·0	1·18
November	1,026	71·8	0·28
December	568	67·9	—

The annual mean temperature in this abstract is 76°, and the monthly mean range is 20·6°. The annual average rainfall is 31·31 inches, but it will be observed that 28·74 inches fall in June, July, August, and September, and that most of the years fever mortality takes place during the monsoon and the drying-up months. There is nothing in the facts differing from what takes place at other stations, and it can scarcely be said that the excess of intermittent fever is primarily due to climate.

28. But, as related to these climatic elements, we have the facts in regard to drainage and subsoil damp already referred to, and Mr. Hewlett sums up the case in the following words:—"In my opinion "the most fruitful source of malaria in Mhow is the marshy and waterlogged condition of the valley "on the south and south-west of the station. This is the source which principally affects the infantry "and artillery, whilst the undrained condition of the ground on each side of the Gumbir river affects "the cavalry." He even proposed that the cavalry should be removed to Ahmednagar for the improvement of their health.

29. Besides these topographical causes of malaria, there are others connected with local domestic customs, such, for instance, as want of house drainage, cesspits, want of adequate methods of draining away lavatory, bath, and cookhouse water, defects which refer not only to the bazaar, but to the different barracks. As we have often pointed out, all water supplied to a cantonment population for domestic purposes is simply an added disease cause unless it be removed after use. And we quite agree with Mr. Hewlett on the general principle that all such water should be carted away, "unless it "can be made to convey itself through an impervious channel to a safe distance from the barracks "and wells."

What appears to be required in the way of drainage is to relieve the subsoil under and around barracks and quarters of the water liable to accumulate in it after the rains. Drainage work should be local apparently, instead of general, and provision should be made at the same time for removing all refuse water by drains. The former measure refers to sites, and, properly considered, it is a necessary preparation always to be done before the site is built on; the latter is really part of the barrack or house. At Mhow, as at other stations, all merely local sources of malaria, such as those described by Mr. Hewlett, should be drained.

30. *Water-supply.*—"The military and civil population at Mhow is entirely dependent on surface "wells for its water-supply, for there is no deep spring in Mhow, and the storm water sinks into the "moorum, and thus finds its way along the surface or into cracks, in the subjacent trap; and when "it is remembered that the gathering ground is thickly populated by a large garrison with its "numerous native followers, animals, &c., and that there is a native population exceeding 22,000 "persons, it must be evident that the filtering medium must become choked with impurities in time, "and some of these must get washed into the wells."

Nobody can doubt who considers these facts, that, to say the least of it, the water-supply of Mhow is of a dangerous character. Some well waters are shown by analysis to be better than others, but it is the method and its uncertainties which are at fault. For example, there are wells which yield about a grain of chlorine, or even less, per gallon, while there are others which yield 10, 12, 17, 20, and 23 grains and upwards per gallon. One bazaar will yield above 27 grains of chlorine per gallon.

We shall not discuss this subject further, as we entirely agree with the authorities that an independent supply is necessary; but it may show the want of interest or of knowledge of the subject if we state that, while money was being saved for this indispensable purpose, the amount, Rs. 1½ lacs, was appropriated, by order of another authority, "for the purpose of making feeder roads."

31. *Conservancy.*—In the absence of house drainage, and the consequent use of cesspits, the cleansing of this large cantonment has to be effected by hand labour. In some details pointed out by Mr. Hewlett the work might be improved.

32. *Barracks.*—The Report contains full details about the barrack construction, together with proposals for improving some of them, but the great defect is the want of ventilation under the floors.

33. *Bazaar.*—We have already noticed some points in the bazaar arrangements for animals. The subject has been discussed in previous Memoranda, and the local authorities appear to be fully alive to the improvements required.

The place is frequented by soldiers, who drink the foul well water, and are exposed to the foul air, and, such being the case, it is not surprising that if a man is attacked with ague it may become developed into a more severe and fatal fever type.

But the real inefficiency cause at Mhow is malaria, partly general and partly local, and the risk of impure water; and the facts, as Mr. Hewlett has put them forward, point to improvements in these matters as the remedies required.

11th August 1884.

No. 4.

Memorandum of the Army Sanitary Commission on the Report of the Sanitary Commissioner for Bengal for 1882.

1. The statistics in this Report are calculated on the census of 1881, which yielded the following results:—

Under Registration.	Population.
45 rural districts	63,639,056
95 towns	2,466,970
Total	66,106,026

But this total only represents the population of areas under registration, which had not yet become co-extensive with the census areas of 1881, for these yielded the following numbers:—

Males	34,220,905
Females	34,601,015
	68,821,920

The population details for Sikkim were wanting, so that the sexes were not separated, and Naga Hills were not under census. The total population of 1881 was 68,829,920, but, as already stated, the ratios are calculated on the smaller number. It is satisfactory at the same time to know that this registering number is increasing.

2. Arranged according to classes, the registering population was as follows. The death and birth rates of each class are added.

Classes.	Population, 1881.	Deaths per 1,000 in 1882.	Births per 1,000 in 1882.
Christians	100,915	14·20	25·00
Hindus	42,896,410	20·48	22·22
Mahomedans	21,361,687	20·71	23·26
Buddhists	79,721	2·88	4·25
Other classes	1,667,293	16·09	11·14
Total	66,106,026	20·41	22·48

Registration of births was conducted in 45 towns only, and even in these towns, with their better registration machinery, the registered birth-rate in 1882 was only 22·48 per 1,000 of population. This birth-rate of 22·48 per 1,000, with the death-rate of 20·41 per 1,000 given above, require no comment, unless it be that both of them show the present state of the registration, and that neither can be accepted as trustworthy facts, or as representing the actual birth and death rates of the province. They are only approximations, and as such must be accepted for the present.

3. The following abstract gives the population, areas, and death-rates of each district in Bengal:—

District.	Population, 1881.	Area in Square Miles.	Death-rates per 1,000.	District.	Population, 1881.	Area in Square Miles.	Death-rates per 1,000.
Nuddea	2,017,847	3,404	39·37	Bhagulpore	1,966,158	4,268	19·40
Burdwan	1,891,823	2,697	35·42	Cuttack	1,738,165	3,517	19·32
Birbhum	794,428	1,756	34·34	Mozufferpore	2,582,060	3,003	19·05
Bankura	1,041,752	2,621	32·21	Lohardaga	1,609,244	12,045	18·11
Moorshedabad	1,226,790	2,144	30·80	Noakholli	820,772	1,641	17·82
Patna	1,756,856	2,079	29·28	Dinagepore	1,514,346	4,118	17·18
Jessore	1,377,249	2,276	29·26	Durbhunga	2,683,447	3,335	16·98
Backergunge	1,900,889	3,649	28·06	Shahabad	1,964,909	4,365	16·55
Rajshahye	1,388,638	2,361	27·82	Manbhum	1,058,228	4,147	16·33
Balasore	945,280	2,066	27·27	Julpaiguri	581,562	2,884	15·34
Hughli	660,813	830	24·78	Singbhum	561,964	4,336	15·21
24-Pergunnahs	1,869,859	2,120	24·07	Howrah	635,381	476	15·09
Bogra	784,758	1,498	24·04	Sarun	2,280,382	2,622	14·85
Khoolna	1,079,948	2,077	23·90	Monghyr	1,969,774	3,931	14·66
Pubna	1,311,728	1,842	23·84	Hazaribagh	1,404,742	7,027	14·60
Purneah	1,848,687	4,956	21·66	Tipperah	1,519,338	2,491	14·16
Poori	888,487	2,473	21·60	Chumparun	1,721,608	3,531	13·90
Maldah	710,448	1,891	20·86	Rungpore	2,097,964	3,486	13·49
Dacca	2,116,350	2,797	20·84	Faridpore	1,631,734	2,247	13·15
Midnapore	2,517,802	5,082	20·66	Sonthal Pergunnahs	1,568,093	5,456	11·05
Chittagong	1,132,341	2,567	20·05	Mymensing	3,051,966	6,287	8·94
Serampore	1,351,955	343	19·59	Darjiling	155,179	1,234	7·01
Gya	2,124,682	4,712	19·49				

The first three or four districts in this list are the only ones in which death registration was carried out in 1882, with even approximate accuracy, and there is every probability that even in these instances the ratios are under the truth. Neither is there any correspondence between the density of population and the registered deaths. But the data show where improvement in the machinery of registration is required, and this, indeed, is their chief utility. There are no means of obtaining the birth-rates for these districts. The general rate of 22·48 per 1,000 is obtained, in the only available way, by striking an average of the rates registered in 45 towns situated in 30 districts. We must make the best use we can of such district data as we possess, in the hope that future years may yield more accurate results.

4. Divided between the rural and urban populations the death-rates of 1882, compared with those of the previous five years, were as follow:—

	Population, 1881.	Deaths per 1,000.	
		1882.	Previous 5 Years.
45 districts	63,639,056	20·00	15·37
95 towns	2,466,970	31·05	30·63
Registering population	66,106,026	20·41	15·94

These data simply show that the registration of deaths has been undergoing improvement. The town death-rates differ from each other to as great a degree as do the country rates. But generally they bear marks of better registration. Only 13 of them return death-rates under 20 per 1,000, and from this ratio the returns gradually rise to 30, 40, 50, per 1,000. The highest rate of the year, 57·26 per 1,000, was returned from Puri, against a preceding five years' average of 62·04 per 1,000. The following instances may be quoted as showing curious irregularities in registration:—

Towns.	Population.	Deaths, 1882, per 1,000.	Deaths, previous 5 years, per 1,000.
Sitamurhi	6,125	29·38	84·01
Sudharam	5,124	15·61	80·75
Boidobatti	14,718	24·45	79·18

The only remedies for these discrepancies are time and experience. The authorities are quite aware of the bearing of these facts on the sanitary problems in Bengal, and continuous efforts have been made to improve the registration; it is necessary, however, that we should draw attention to them, because of their practical bearing on administrative matters, and also because there has been apparently less progress made in Bengal than in certain other provinces in this important branch of public health work. Under these circumstances it is not necessary to discuss the general vital statistics further.

5. The following were the deaths and death ratios registered in 1882 under the usual heads:—

Diseases.	District Mortality. Population, 63,639,056.		Town Mortality. Population, 2,466,970.		Mortality of Province. Population, 66,106,026.	
	Total Deaths.	Deaths per 1,000.	Total Deaths.	Deaths per 1,000.	Total Deaths.	Deaths per 1,000.
Cholera	170,522	2·67	11,830	4·79	182,352	2·75
Small-pox	12,798	·20	853	·34	13,651	·20
Fevers	891,151	14·00	38,792	15·72	929,943	14·06
Bowel complaints	51,662	·81	9,700	3.93	61,362	·92
Injuries	20,660	·32	951	·38	21,611	·32
All other causes	126,257	1·98	14,475	5·86	140,732	2·11
All causes	1,273,050	20·00	76,601	31·05	1,349,651	20·41

It will be observed that the town mortality in this abstract greatly exceeds the district mortality under all the registration headings, but this result is most probably due to better municipal registration. It is further not unlikely that detailed examination would show that many towns were, on the whole, in a better state under administrative improvements of recent years than are most country districts and villages, and the low registered death-rates in these latter centres of population would thus again point to deficiency of registration. We shall state briefly the results of the present year's report, under each of these heads.

6. *Cholera.*—The year 1882 was one of the great epidemic years in Bengal, as will be seen from the following abstract of cholera mortality given by the Sanitary Commissioner:—

Years.	Deaths from Cholera.	
	Total.	Ratio per 1,000.
1872	37,536	·56
1873	58,673	·88
1874	56,876	·86
1875	108,262	1·63
1876	196,590	2·97
1877	155,305	2·34
1878	95,192	1·43
1879	136,363	2·06
1880	39,648	·59
1881	79,189	1·19
1882	182,352	2·75

There are no other facts which would enable us to solve the questions presented by this table, and they must be recorded just as they stand, in the hope that in time we may be able to account in some sense for them.

7. Deaths from cholera were registered in 609 circles of registration out of 641 in the districts. No part of Bengal escaped the epidemic of 1882, and it attacked an unusually large number of villages (no fewer than 27,314 out of 201,989, or above 13 per cent.), and the deaths averaged between six and seven per village.

8. The next abstract gives the monthly prevalence of cholera in Bengal for a series of years in connexion with the monthly rainfall for 1882:—

Months.	Average Cholera Deaths, 1877 to 1881.	Cholera Deaths, 1881.	Cholera Deaths, 1882.	Rainfall, 1882.	Average Rainfall of previous Years.
				Inches.	Inches.
January	12,299	3,999	8,947	·09	·49
February	6,744	2,616	7,589	·78	·88
March	8,849	2,119	15,692	·30	1·00
April	14,875	13,434	25,587	1·07	1·51
May	11,433	10,833	27,544	5·13	4·09
June	10,121	5,324	22,358	9·24	10·22
July	8,944	6,758	18,135	10·65	13·72
August	6,858	7,155	12,917	12·50	13·26
September	3,322	2,499	5,684	9·23	9·93
October	2,773	2,712	6,756	8·81	4·98
November	5,598	3,674	12,357	1·16	·64
December	9,364	3,753	18,714	·04	·20
Totals	101,135	79,180	182,352	57·66	60·99

The facts presented in this abstract are interesting, for they show,—1st, that cholera is epidemic in Bengal throughout the year; 2nd, that it has two periods of increase, the first including November, December, and passing onwards to January of the succeeding year, the second, March, April, May, June, and July; 3rd, February, September, and October are the months of lowest cholera mortality; 4th, that the cholera of any one year is only a year's event taking place in the general epidemic history of the province, which is a connected current history, and includes the apparent passing over of cholera death-rates from the end of one year to the beginning of the next year; 5th, that increase of cholera mortality co-exists with little rain, and declines when the rains have fairly set in; that the very high cholera death-rate of 1882 co-existed with a diminution of 3·33 inches of rain in that year below the average, nearly the whole of which took place during the months of maximum prevalence of cholera. From another table in the Report we learn that the mean temperature of 1882 differed only fractionally from the average, so that so far as climate is concerned, rise in cholera mortality co-existed with diminution of rain when it was most needed.

9. The mortality from this epidemic varied greatly in different districts of Bengal, and there was little apparent relation of intensity between the cholera of 1882 and that of preceding years in the same districts. In 10 districts the cholera death-rate of 1882 was under 1 per 1,000. In 10 districts it lay between 1 and 2 per 1,000; in other 10 districts it was between 2 and 3 per 1,000; in seven districts it was between 3 and 4 per 1,000; in six districts between 4 and 5 per 1,000. The highest rates of the year were 5·46 per 1,000 in Nuddea, 8·05 per 1,000 in Jessore, 6·24 per 1,000 in Balasore, and in the suburbs of Calcutta, outside the limits of municipal sanitary works, there died 2,476 inhabitants out of 251,438, or 9·82 per 1,000. This great mortality was, properly speaking, attained in an urban population whose cholera death-rate for the preceding five years had been as high as 7·27 per 1,000, the highest of any population group for the period. Of the 95 towns three

only escaped cholera. In very few of them was the death-rate under 1 per 1,000. In the majority, the rates exceeded 2, 3, and 4 per 1,000, and some yielded much higher death-rates than even these. Rates above 10 per 1,000 were returned from the following towns:—

Towns.	Death-rates per 1,000.
Serajgunge	10·31
Serampore	10·83
Faridpore	12·47
Poori	13·33
Meherpore	13·78

Part of these higher rates may have been due to greater accuracy in the registration. This part of cholera history may be briefly summed up as follows:—

Total registering population	66,196,626
Total population groups	201,989
Total cholera deaths, 1882	182,352
Population groups yielding these deaths	27,314
Cholera death-rate per 1,000 for total population	2·75
For previous five years per 1,000	1·52

10. We have no means of arriving at the population of attacked villages, but if it represented the same ratio as existed between attacked and unattacked groups, we should have to multiply the death-rate by about seven to represent the death-rate of the population which suffered.

In January a few districts returned no cholera deaths, but some of these were attacked in February, and others in March; April and May saw the epidemic pretty generally diffused over the Presidency, but although some of the districts escaped in January and February, cholera appeared in all the divisions of Bengal in January. There was no appearance of movement in the epidemic itself, for it covered its ground at the commencement of the year. There was, however, an appearance of movement in the death ratios, which yielded higher rates in the delta divisions at earlier periods than was the case in the North-Western areas. The same facts presented themselves in the North-Western Provinces, where the maximum death-rates moved like waves from the borders of Bengal to those of the Punjab, although cholera may have existed previously more or less over the entire area.

11. The law of cholera in the north of India appears to be as follows:—

(*a.*) General diffusion of cholera of low intensity.
(*b.*) Increase of intensity in the delta regions (Dr. Bryden's endemic area) as the season advances.
(*c.*) Movement of the maximum mortality from the delta districts towards the North-Western districts of Bengal, and from them onwards into the North-Western Provinces and Oudh.
(*d.*) The amount and movement of cholera mortality is related to climatic causes, chiefly to rain-fall; and,
(*e.*) As we shall see further on, the same amount of rain which lowers the cholera death-rate increases the amount of loss from fever.

12. The experience of 1882 shows, like that of all previous years, how little we know of the action of climatic causes on the prevalence of cholera, and how wholly these are beyond our control. We have no reason, however, to suppose that the action of climate is other than secondary. There is no proof that climatic causes will produce or increase cholera by their direct action, but we do know that there are secondary causes which may be either increased or lessened in their activity by the amount of rain, and it is with the secondary causes alone that we can in any measure cope by sanitary precautions. It has never been asserted that cholera was produced by such causes, although, from the manner in which they are dealt with in the following paragraph, it would appear as if the view still existed in India. In paragraph 47 the Sanitary Commissioner states the results of the year's reports in the following words:—"The reports of the year do not cast any new light on "the etiology of the disease. Polluted sources of drinking supply are always more or less suspected, "and local sanitary conditions are very generally indicated as exciting or predisposing causes; but it "is also to be remarked that in several instances local incidence of the disease is quite independent "of local conditions. Climatic insalubrity, deficient rainfall, imperfect drainage, the retention of "moisture and damp in the soil, errors of diet, infection, importation, &c., are all in their turn "accused of favouring, if not absolutely originating, the disease."

The chief defect in this statement is, that the reports summarized do not appear to have given the details of the several instances "where local incidence of the disease is often quite independent of local conditions." Such information, if technically accurate and not mere opinion, would have been of great value. It has never been denied that the epidemic influence of cholera may in itself be so intense as to kill every one exposed to it. For instance, all the cases which now assume the character of ordinary diarrhœa might on this supposition pass directly into collapse and death. So that while in one set of cases the local defects might co-exist with diarrhœa only, of which the vast proportion might recover, in the other set all might die while the local causes remained the same. What is called an "epidemic," whatever the disease may be, varies in intensity, and the relation of local insanitary conditions to the mortality from epidemics is, in the present state of our knowledge, simply a matter of observation and experience, and here we have quite sufficient facts in India alone on which to found consistent schemes of local sanitary improvement with the certain expectation of beneficial results.

13. Here, for example, is one of the earliest of the paragraphs about cholera in the Report under review :—"With the exception of a few insignificant outbreaks of cholera which occurred at the fairs "held at Turkessar in Hughli, Manda in Rajshahye, Faridpur in Pubna, Baroni in Dacca, Sing- "hessur in Bhagulpore, Caragolah in Purneah, and Hurwa and Gunga Saugor in the 24-Pergannahs "(in the latter of which fairs the largest number, 15 cases, took place), all the other fairs, large "and small, were exempt from this disease. This is a very remarkable observation, and, con- "sidering that cholera was rampant all over the province in an unusually severe manner at the "time the fairs were held, this immunity speaks well for the care and attention bestowed in adopting "sanitary precautions against its inroads."

Now, suppose the villages had been as well attended to in their sanitary arrangements as the fairs appear to have been, what result should we have been justified in expecting? And does this experience not prove anew that, under improved sanitary conditions at fairs, the villagers present at them are safer from attacks of cholera than they would be at home, although in former times fairs and their accompanying filth, bad water, and overcrowding were the foci of local epidemic outbreaks of cholera.

14. We shall abstract from the Report a few illustrations of those local conditions under which cholera prevailed; the first shows that unwholesome trades conducted without proper care may be exciting causes of this disease in India as elsewhere.

Cholera prevailed epidemically at a village in Bankura town, which was in a bad sanitary condition. It contains several lac factories, "the refuse water of which is allowed to stand and decompose in shallow ditches." An outbreak occurred in Mijia, which was attributed to pilgrims, but "the magistrate justly condemns the prevailing practice in this locality of heaping cowdung, house sweepings, &c., till they become fit for manure" in open pits, and he advises the adoption of a safer practice in use in India of pitting the manure in ricefields immediately after the crops are harvested. We concur with the Sanitary Commissioner in the opinion that the effect of this method should be further considered with a view to legislation. Many similar important disease causes might be abated by equally simple expedients.

In Soori cholera prevailed from January to September, and out of 1,908 villages 266 yielded 2,264 deaths. Soori town yielded 12 of these deaths only, and they are said all to have occurred within 100 yards of a locality near the Serai, where a traveller suffering from vomiting and purging sought shelter three or four days before. Several people in a house opposite, "who drew their water from a well near the Serai," were attacked, but "when the use of the water was prohibited, only one or two cases occurred within a week's interval." Perhaps the traveller was attacked because he used this same water; but it will be seen that such is not the inference suggested. The town cholera was really part of the district cholera.

In Rampurhat, in the same district, 50 villages out of 1,180 were attacked, and 329 cholera deaths were registered among them. The magistrate considers that an extension of medical relief is required to meet such events, "but," says the Sanitary Commissioner, "while this demand is made "on the medical establishment after the disease has succeeded in gaining a hold upon the people, "what are we to say of the habits of these people when the civil surgeon can write that water for "drinking and other domestic purposes is generally drawn from wells in private compounds, which, "'for the sake of convenience, are built near the privy,' and the adjoining site selected for washing "cooking utensils, depositing of various descriptions of house refuse, and for habitual urination by "all the members of the family?" There is, in our view, no doubt as to the practical accuracy of this view of the case. In a country like India, which suffers enormous losses year after year from epidemic illness as well as from deaths, it is practically impossible to cover the ground with medical aid and appliances. What can be done, however, if it is properly set about, is the prevention, or at all events the reduction of these losses by sanitary measures which in their nature are neither difficult of execution nor costly, and for which the agency is at hand in the villages themselves, if it be only properly organised and directed, as appears to have been the case at the fairs.

In a locality in Midnapore district cholera is seldom absent, and the cause is supposed by the people to be in the saliferous nature of the soil. "The drinking water in these cholera tracts is bad, and the deputy magistrate is disposed to attribute to it the originating cause of cholera."

In Hughli districts 188 villages out of 1,951 suffered from the epidemic, and 644 people died. In the village of Champdani, which was crowded with coolies from the neighbouring jute mills, the disease prevailed epidemically. "Here no sanitary precautions of any kind appear to have existed. ". . . The magistrate considers the sanitary condition of the villages in the district to be bad "in the extreme. Amongst this, the densest population existing in any portion of the globe, there "are as a rule neither privies nor latrines."

Here is a case close to the capital of India. Why can it not be laid hold on at once, and the whole affair put an end to, at the cost of the people who collect labourers for their own profit, and leave them under such conditions?

In Serampore the mortality was "very severe, aggravated as it was by a very fatal outbreak among the coolies of the Wellington jute mills in Rishra," where the sanitary defects, it may be predicted, did not differ greatly from those mentioned above.

Cholera was very fatal in several parts of the Presidency division. It prevailed extensively and fatally in the suburbs of Calcutta outside municipal limits and in certain portions of them, of which it is said: "These bustis are the most unhealthy of all, and the inhabitants filthy beyond conception. "The surface drainage is everywhere obstructed, and what drains there are are full of black oozy "mud, almost entirely composed of sewage, fermenting in the sun and emitting at all times a "sickening and unendurable steneh." Drinking water properly so called is unattainable, tanks

are contaminated in every possible way. During the jute season crowding in temporary huts without conservancy exists. Other localities which suffered much from cholera are densely populated, houses crowded, and open drains and cesspools, ponds, and hollows, containing thick and greenish liquid, exist.

In Jessore, the Civil Surgeon of Majura subdivision attributes "the invasion of the disease to "the insanitary condition of the villages, to the use of polluted water, and perhaps in a less degree "to eating insufficiently matured rice. . . . The magistrate does not coincide in these opinions, "and somewhat glibly remarks that these are mere guesses of no value, as medical science knows "absolutely nothing about the cause of cholera, and as little about the cure of it." It may be suggested in passing that the magistrate himself has mistaken the question at issue, which is neither the "cause" nor the "cure" of cholera, but the determining conditions of local outbreaks which are matters of long observation and experience. He may do great good without knowing the cause or the cure of cholera by simply improving the sanitary condition of his villages, without mixing up this practical point with purely medical discussions.

15. By way of encouraging improvements in this direction, we may cite the experience of Beauleah town in Rajshahye, of which it is stated that "the civil surgeon, with much reason, "attributes the great immunity from cholera which Beauleah town enjoyed this year in com-"parison with the preceding one, during which the death-rate was as high as 8·28 per 1,000, to "the town having had its tanks and filthy pits thoroughly scoured out by two successive inunda-"tions of the Ganges, and to the introduction by the municipality of better conservancy arrange-"ments and a cleaner water-supply." In this town the cholera death-rate in 1882 was 2·07 per 1,000, instead of 8·28 in the preceding year, while Rajshahye district itself had a five years' average death-rate of 1·14 per 1,000, which was raised by the intense epidemic of 1882 to 2·08 per 1,000, not far short of double the average, although slightly under the rate of 1881, which was 2·48 per 1,000.

16. An instance of an imported cholera case is given which, if it were true, would be in contrast to the experience already stated. In Rungpore a case was imported by rail from Eastern Bengal. "The case," the civil surgeon says, "was quickly brought to my notice, and the discharges were "completely disposed of, no other case occurred in the town. Had this man's discharges been "allowed to pollute the ground and thence to drain into a neighbouring well, or his clothes been "washed in the public tank, we should have had, as is too often the case, a fatal outburst among the "population." This statement of the case is not quite accurate, because the table shows that there was another case in the town, so that cholera was there apart from the imported case. In Rungpore district itself, cholera deaths were registered in 16 out of 17 registration circles, and in 204 villages out of 4,206, and besides all this, it has yet to be shown that cholera excreta are more likely to produce outbursts of cholera than non-choleraic excreta. On this point we have not been able to obtain any proof, but rather proof in the contrary direction. The truth of the matter probably lies in this, that filth of all kinds, if in a state of putrescence, is dangerous, but that there is nothing of a specific nature in the results of putrescence to occasion cholera any more than any other disease. We have noticed this case, because of its logical bearing on sanitary precautions against cholera. It only remains to be stated that cholera existed in Rungpore district during every month of 1882, a fact which is itself destructive of the excretal theory. We have nothing to say against the measures adopted in this special case, only they ought to have been extended to all filth in the district, and before cholera appeared.

17. The cholera outbreak in Dacca town presents a few points of interest. The well-water of Dacca, as is clearly shown in a separate report by the civil surgeon, is quite unfit for drinking and culinary use, and the town has lately been supplied with better water, but this has not yet been distributed to the whole population. At the time cholera appeared the country was under water, and according to previous experience there ought to have been little or no cholera on this account; nevertheless, the district had a death-rate of 2·76 per 1,000, and the town of 6·57 per 1,000. Flooding of surface is, therefore, not necessarily a safeguard against cholera under all epidemic conditions, and in Dacca town cholera was fatal even with better water. The history, however, as given by the Sanitary Commissioner, clears up the case. The improved water-supply was introduced in May 1878, and the following annual cholera deaths will show its relation to cholera mortality:—

Years.	Deaths.	Years.	Deaths.
1875	194	1879	118
1876	205	1880	15
1877	289	1881	85
1878	167	1882	527

These data show an apparent relation between better water and lower cholera death-rates, but as a fact the better water is used by about a third only of the population, and the increased death-rates of the last two years have led to "a tendency to discredit the value of the hydrant water." This result is simply a consequence of one-sided views about the influence of water on health, and if it were a necessary consequence it would show that impure water was not so great an evil to the public health as had been supposed, and moreover, that the expenditure on the purer supply had been unnecessary. But besides extended distribution of the supply to the whole population, other

measures of protection from cholera are necessary, as will be seen from the following facts:—"The "disease in epidemic form broke out on the 15th July among some 40 coolies living in two filthy "huts, calculated to hold only 25 men, situated in the middle of the town, not far from the "kutcherries, the inmates sleeping on a damp floor, hardly raised above the level of the ground, "and drinking from a well which was manifestly impure." . . . . "The magistrate and the "vice-chairman attribute this outbreak to impure water, to the insanitary condition of privies, and "to the large 'gors' (cesspits) which are used as general receptacles for the contents of privies and "filth generally."

This statement points directly to practical measures, and these are, supplying hydrant water all over the town, and filling up all wells, abolishing all cesspits, privies, and places of deposit of filth within the town, and providing for the collection, removal, and disposal beyond the limits of the town and suburbs of all filth and impurities by an improved conservancy system. These measures, and not better water alone, are required to meet the facts of the case.

But, nevertheless, the extension of cholera in Dacca is brought under an extension of a home theory that epidemic diseases are spread by milk because the goalas, who supply the town with milk, suffered from cholera, and diluted their milk with foul water. This points to getting rid of the goalas and their belongings as the real preventive of cholera. Any way they should be brought under the same sweeping sanitary improvements as are required for the town.

18. Similar remarks are applicable to the Chittagong report. The cholera death-rate in this district was 2·41 per 1,000, and in Chittagong town, the bad sanitary state of which is well known, it was 2·84 per 1,000. This death-rate appears to have been considered satisfactory, and was, in the estimation of people on the spot, arrived at by the following method. The locality "was surrounded, "bonfires made in every direction amongst these houses, and sulphur sprinkled on the fires, all the "bedding and the clothes soiled by cholera dejecta, which could be got hold of, were burnt. The "soil where contaminated by discharges was scraped up, and fires lighted over it, and thus by timely "measures the conflagration was localized and eventually stamped out." It will be observed that these proceedings, which were attended by a larger death-rate than that of the district generally, were founded on a theory about cholera, and their practical result will probably be to leave the bad sanitary state of this town just where it is. What requires to be done for Chittagong lies in another direction altogether. Bonfires and burning sulphur will neither drain the town and its vicinity, nor fill up foul ditches and tanks, nor will they improve the water-supply or the conservancy arrangements.

19. Gya town had a death-rate from cholera of 9·30 per 1,000. "The disease was almost solely "confined to the northern quarter, which is low, and where the drainage is less efficient and sanitary "arrangements generally less attended to than they are in other parts of the town." This statement of the case points directly to the remedy which is in the hands of the municipal authority, and which that authority should be called on directly to apply.

20. Dumraon town in Shahabad yielded a cholera death-rate of 8·18 per 1,000. It is stated to be "a fairly clean town," but we have long ago urged the little importance to be placed on mere surface cleanliness, because the filth which causes disease is not there, but in the compounds and houses with cesspits and wells dug close to others in the same foul ground.

21. Mozufferpore district had a cholera death-rate of 4·68 per 1,000, and 16 per cent. of the villages were attacked. Nothing is said about their sanitary condition, but two statements are made about the disease which may be quoted. The first is that "the people in this district are generally "fully aware of the dangers arising from visiting or in any way approaching cholera-infected "localities." This is as it should be, only every effort should be made by sanitary improvements to diminish the number of these cholera localities. Keeping out of them until they are improved or cholera ceases is the only measure of separation of the least use. But that the danger lies in the affected locality is shown anew by the other remark of the civil surgeon, who says:—"The people "from affected localities congregate in large numbers in and about the markets held weekly in the "district," and he records "that he has failed to connect the spread of the disease with the free "intercourse which takes place at these markets between the people from affected with those from "healthy villages." In these two statements are contained a whole history of cholera in its practical bearing on sanitary work and precautions.

22. The following facts about cholera in Durbhunga district are also of interest, because they include climatic conditions, epidemic movement, and the effect of local conditions. In 1881 the cholera death-rate was ·12 per 1,000, and 2 per cent. of the villages were attacked. In 1882 the death-rate mounted up to 4·14 per 1,000, and 29 per cent. of the villages were attacked. The maximum mortality took place in April, May, June, and July, chiefly in May and June. The months of June and July had abnormally deficient rainfall; the rains were re-established in August, and the deaths fell from 3,754 in June and 1,686 in July to 567 in August, and thence to 26 in December.

The civil surgeon thinks that the disease crossed the Ganges from North Bhagulpore. The magistrate refers its localization to "the filthy habits of the people and to the stagnant tanks, which form a network all over the district." These facts are in no sense contradictory, but, taken as a whole, they teach us that, while we can neither control or turn aside epidemic movement nor influence rainfall, we can deal with the localizing causes described by the magistrate.

23. Sarun district suffered severely from cholera, and "the presence of the disease," says the civil surgeon, "could not be traced to or explained by local insanitary conditions." Were this view

correct, Sarún would stand out in marked contrast to other Bengal districts. But the statement only shows defective inquiry or incorrect estimation of the facts. Such, besides, is not the view of the magistrate, "who informs us that the cause of excessive virulence of cholera in the subdivision in "which it raged cannot be said to have been *ascertained*, but it is the worst-drained tract in the "subdivision, and is, therefore, always more or less in an insanitary condition." This case appears to have been one of those in which cholera and bad sanitary condition prevailed over a certain area of country, and where, from some not very evident cause, it was more fatal in one portion of it. The reason assigned by the magistrate is probably the true one.

24. Cholera prevailed in Monghyr district of Bhagulpore division during every month of 1882 except December, and yielded a death-rate of 2·71 per 1,000. All the registration circles recorded cholera deaths, and these deaths, which numbered 5,351, took place in 681 villages out of 3,457 in the district. It is necessary to bear this history in mind to be able to estimate the value of the following importation case, of which, be it observed, no details or dates are *given*. "This year a man in his "way back from Deoghur died of the disease at Khyra, and immediately afterwards an epidemic "conflagration was set up in that village, spreading rapidly to the three northern thanas." Cases reported in this fashion require no comment. It might, apparently, be urged that the *man fell a* victim to the village cholera rather than the village to the man. In Jamalpore thana in *this district* the cholera death-rate attained no less than 19 per 1,000, showing high epidemic intensity.

Another importation case from a specified village is given for Bhagulpore district, but it was found on inquiry that there was no cholera to import.

25. There is an importation history, given more in detail, which requires special notice, in connexion with Caragola fair, towards the end of February, when the people began to disperse. As already stated, an "insignificant" outbreak took place at this fair, and it is on this occurrence that the history hangs. The precise dates of the fair, the numbers present, the sanitary measures adopted, and the number of cases, are not given. The only facts dwelt on are the fair and the dispersion of the people; all else is a matter of opinion. The site of Caragola fair is in Purneah district of Bhagulpore division, in which there were 8,777 deaths from cholera, and 23,919 cholera deaths in the division. The fair was held some time in February, but the alleged outbreak took place after the dispersion of the people at the end of the month. In Bhagulpore division there were 19 cholera deaths in January and 636 in February. Purneah district yielded 511 of these deaths in the same month. So that whatever influence the fair exercised, it could not be blamed for having caused the epidemic, which indeed covered nearly the whole of Bengal during these two months. In the course of the year every registration circle in Bhagulpore division returned cholera deaths, and 2,636 villages out of 22,658 were affected. Now, although the amount of cholera at this fair is styled by the Sanitary Commissioner as "insignificant," it is considered to have spread the disease to all the district by travellers from the fair. The statistics show conclusively that cholera prevailed at the time over the entire province within an area about 600 miles in length by about 400 in breadth, and along certain roads there were, as there always are, people travelling; and in the absence of any facts to show the relation of these people to cholera prevalence, we are expected to place the two events in the relation of effect to cause, or at all events to assume the arrival of people in this special case as the cause for the epidemic in Purneah and Bhagulpore, for it was an epidemic. There are three views given of the etiology by the civil surgeon:—

1st. That the disease was communicated by human agency from Caragola.

2nd. That its spread was attributable to contamination of the water-supply.

3rd. Amongst the predisposing causes of outbreak at the fair are enumerated "excessive overcrowding, want of suitable shelter, days and nights of fatigue, indiscriminate use of food, bad water, "atmospheric changes, and the like; and then the magistrate reports that only a few cases of cholera "actually occurred at the fair." If we knew how many people were at the fair, the number of cholera cases there, and the sanitary precautions actually adopted, we should be better able to form a judgment on this case; but, taking the facts as they stand, they appear to show that, at a time when a great epidemic was about to break out, and when it had already shown its presence all over the province, this fair was held, and the people dispersed at the time of the outburst, and were exposed to the usual influences of fatigue, crowding, &c., in villages where cholera already existed or was on the eve of appearing, and some of them suffered. This appears to have been the real history. There is no necessity to invoke "contagion" as a cause, for all the facts of the Bengal epidemic of 1882 render such support unnecessary, and it is quite certain that "contagion" can give no account of the year's cholera statistics.

Our view of the facts is that opinions resting on bases so slight should never appear in sanitary reports, but what ought to have appeared in full was a statement of the sanitary condition of affected groups of population, where the pilgrims lodged, for which we search in vain in the Purneah cholera report. But even the general statement of local causes elsewhere, so far as it goes, is very instructive, and points to the real remedies. For example, the sub-divisional officer of Godda, from his own personal observation, reports "that cholera was most fatal wherever the villages were filthy and "overcrowded, and where the water-supply is impure. Such was the case notably in Matin, Dureh, "Maheshpur, Belhudda, Bhaska, Lohondia, Bazaar, and Jaharkitta, in Barkope." It is obvious that if pilgrims from Caragola fair entered villages in this condition, and just at the time when a great epidemic was coming, they would almost certainly suffer, but if the contagion etiology be adopted, the fair would have to bear blame, and not the villages. Seeing that this group of villages was inspected, why should they not have been taken in hand at once and improved? This is the logical conclusion from the facts. Cholera was very fatal in Orissa division, and a similar account of the infected villages is given.

26. The year's epidemic condition of cholera extended from the land to the river population. European sailors had a death-rate of 14·69 per 1,000, and the native population yielded a rate of 4·52 per 1,000.

27. We have to thank the Sanitary Commissioner for his statement of the localizing causes of cholera during the great epidemic of 1882, which we have abstracted as briefly as possible on account of the importance of the facts to future sanitary work. Of course, it has been long known that the population lived under these unhealthy conditions, but in the year's epidemic history the relation of these conditions to epidemic prevalence has been clearly shown. Filth and foul domestic water everywhere invite the entrance of epidemic cholera when it is passing over a country, and it will continue to find a welcome until these conditions have been abolished. The cause and the remedy are both known, and it rests with the Government of Bengal and its officers to apply the remedy.

28. *Small-pox.*—While the mortality from cholera showed a large increase in 1882, it is satisfactory to find that the deaths from small-pox underwent a considerable diminution, as will be seen from the following death-rates for the last four years:—

Years.	Total Deaths from Small-pox.	Ratios per 1,000.
1879	22,843	·34
1880	22,953	·34
1881	24,371	·36
1882	13,651	·20

In 1882 the small-pox deaths divided between town and country circles were, for,—

Urban circles deaths	853
Ratio per 1,000	·34
Rural circles deaths	12,798
Ratio per 1,000	·20

The next abstract shows the monthly incidence of small-pox mortality in 1882:—

Months.	Small-pox Deaths.	Months.	Small-pox Deaths.
January	1,370	July	819
February	1,911	August	428
March	2,571	September	279
April	2,100	October	195
May	1,888	November	221
June	1,461	December	388

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Small-pox was least fatal during the hot months of 1882. Deaths from this disease were returned from all the 45 registration districts, also from 365 out of 644 circles of registration, but out of 201,989 villages the deaths were returned from 5,801. The epidemic covered the whole country in low intensity, and the deaths were confined to little more than 2·8 per cent. of the population groups. The mortality was nowhere very high, but it was greatest in Chittagong and Orissa divisions.

29. The following abstract shows the year's vaccination work:—

	Total Number of Vaccinations.
Calcutta	11,373
Metropolitan circles	344,178
Suburbs of Calcutta	15,152
Vaccination circles	831,618
Municipalities and dispensaries	59,104
Total	1,261,425
This total includes,—	
Primary operations	1,247,277
Secondary "	14,148
Total	1,261,425

Of the total vaccinations of the year there were successful,—

Primary operations, 1,223,561 = 98·69 per cent.
Secondary " 5,497 = 45·12 "

The ratio of primary successful vaccinations was nearly the same in the preceding year, viz., 98·89 per 1,000.

The next abstract shows the ages of vaccinated subjects, together with the ratios at each age to the total successful vaccinations :—

	Successful Vaccinations.		
	Under one Year.	One Year and under Six.	Above Six Years.
Total number vaccinated - - -	158,979	823,129	241,453
Percentages of total - - -	12·81	66·38	19·45

By assuming a birth-rate of 30 per 1,000 of the population, the Sanitary Commissioner calculates the births at 1,299,183, and by comparing this number with the ages of vaccination, it will be seen that much extension of the work is necessary before the ground is covered. Nevertheless, the year's experience shows that life has been saved, as the following facts appear to prove :—

State of Vaccination.	Small-pox Deaths per 1,000.
Thoroughly protected areas - - -	0·02
Fairly well ditto - - -	0·09
Very partially and unprotected ditto - - -	0·26

The next abstract gives the results of a certain number of examined cases to show the efficiency of different protecting agencies as contrasted with non-protection :

Subjects of Attacks and of Deaths.	Attacks of Small-pox.	Deaths from Small-pox.
Vaccinated - - - -	494	57
Inoculated - - - - -	158	86
Previous small-pox - - -	29	5
Unprotected - - - - -	2,120	382
Total - - -	2,801	530

These numbers refer of course to a given group of small-pox cases, but they are interesting and instructive. Of the total attacked the *vaccinated* yielded 17·63 per cent., the *inoculated* 5·64 per cent., and the *unprotected* 75·68 per cent. In the same way 11·53 per cent. of the deaths were yielded by the *vaccinated*, 54·43 by the *inoculated*, and 18·01 by the *unprotected*. It is impossible not to conclude, in this case at least, that inoculation was the means of augmenting small-pox mortality.

30. The staff engaged in vaccination was as follows :—

Rank.	Government Agency.	Licensed Agency.
Superintendents - - -	7	3
Deputy Superintendents - -	5	8
Superintending Vaccinators -	35	64
Vaccinators - - - -	339	825

The total inspecting staff amounted to 122, and the vaccinators numbered 1,164. During the year there were visited by the inspecting staff 27,274 villages. The total outlay for both agencies was 12,408*l.*, and the average cost for each successful case was 1 anna 7¼ pies, but the Government agency expended 3 annas 3¾ pies per successful case, against 10½ pies spent by licensed agency.

These data will give a sufficient idea of the vaccination work of the year. But most of the Report does not require remark, because of its strictly departmental character.

31. *Fevers.*—The section of the Sanitary Commissioner's Report which deals with the fever history of 1882 is one of the most important parts of the year's work, for it really includes as an appendix the report of a Special Committee appointed to inquire into the relation of fever in Nuddea in 1880 and 1881, to certain public works, railroads, roads, embankments, to the execution of which the high fever death-rates had been in part attributed. The fever section itself contains the statistics, together with local notes on fever causes, prepared by the civil surgeons, and the special report, prepared under the presidency of Dr. Lidderdale, contains many facts which, although not new, are nevertheless so analysed as to enable a more accurate idea of these local fever causes to be formed which have helped in times past to decimate the people by outbursts of epidemic diseases.

32. We shall begin our remarks on this section by introducing the following statistical statement of fever deaths in Bengal for the last 12 years:

Years.	Fever Deaths.	Ratio per 1,000.
1871	169,505	2·56
1872	237,868	3·59
1873	303,645	4·59
1874	328,721	4·97
1875	368,087	5·56
1876	561,537	8·49
1877	711,036	10·75
1878	742,887	11·23
1879	622,260	9·41
1880	689,605	10·43
1881	940,911	14·23
1882	929,943	14·06

If the registration of fever deaths had been reliable for these 12 years this table would have furnished matter of alarm. But we may take for granted from the figures that the five earlier years only show that during that period at least the registration was defective. In subsequent years the registration has been improving, but since the scarcity years 1877–78, and their high fever death-rates, fever has either been increasing in Bengal or we are coming closer year by year to the real death-rate. This latter seems the more likely assumption, because in none of the years has the fever death-rate arrived at ascertained rates within certain known limits where the real facts admitted of being arrived at. Another cause of uncertainty is one we have often alluded to, namely, errors in diagnosis. In the present Report, as we shall see, fever deaths are sometimes attributed to ascertained fevers of malarial type, in another fever locality the fever deaths are attributed to supervening pneumonia, and in other localities to the usual complications such as spleen disease, diarrhœa, dysentery, and the like. All, however, are included in the present returns under the fever heading. There is no way out of these difficulties at present, but so far as relates to sanitary work, they are not likely to throw any impediments in the way of it.

33. The next abstract gives the monthly prevalence of fever in Bengal for 1882, and for the preceding five years, together with the monthly rainfall for 1882:—

Months.	Fever Deaths in 1882.	Rainfall in 1882.	Average Fever Death, 1877 to 1881.
January	87,810	·09	63,815
February	67,010	·78	50,849
March	71,519	·59	52,902
April	67,868	1·07	55,692
May	67,517	5·13	50,791
June	60,840	9·61	46,504
July	67,390	10·65	48,466
August	69,935	12·50	55,883
September	74,427	9·23	59,054
October	86,847	6·81	72,041
November	101,207	1·16	91,396
December	108,073	·04	93,943

If we assume the monthly rainfall in this abstract as approximately expressing the monthly ratios of rain over the province, we necessarily arrive at the conclusion that increasing and cumulative rainfall increases fever mortality, that the increase proceeds after rain has diminished, that lowering and variable temperature causes increase of mortality in November and December, which increase passes on to the following year, and then declines until the next rainy season comes round, when the same course is resumed. We shall presently see that there are other fever causes, besides periodical rain (which we cannot control), that are in operation to increase the season death-rates, and which are to a great extent under our control if we choose to exercise it. Rainfall is hence an index or test of local sanitary condition, rather than a direct disease cause.

34. In 1882 fever was universally prevalent in the province, as is shown by the fact that all the 644 registration circles returned fever deaths. Of 201,989 villages, fever deaths were returned from 134,812. The average fever death-rate from town districts was 15·72 per 1,000, for country districts 14·00 per 1,000, and for the entire province, 14·06 per 1,000, against a previous five years' fever rate of 11·21 per 1,000. The difference between the two rates, 2·85 per 1,000, shows the epidemic increase during 1882.

The fever rates varied considerably in different districts. The lowest of the year was in Darjiling. This was 4·58 per 1,000. In several districts the rate was under 10 per 1,000. The highest rate was in Nuddea, where the special inquiry already referred to was carried out. It was 30·18 per 1,000, against a previous five years' average of 21·96 per 1,000. In a number of towns the fever-rate was under 10 per 1,000. The highest town rate of the year was 37·21 per 1,000 at Bishenpore, in Bankura district.

35. We shall next give some account of the local causes of these fevers in the districts, abstracted by the Sanitary Commissioner from the Civil Surgeon's reports.

The first is an observation made by the Sanitary Commissioner himself,—that native workpeople who used for drinking, water which had passed the condensers of steam engines at the factories where they were employed, "enjoyed better health and greater freedom from attacks of epidemics or malarious diseases than the neighbouring population." There can be no difficulty in pursuing this inquiry, as all the materials for it are on the spot. If the results were confirmed, they would afford a new illustration of the utility of boiling impure water before drinking it, and this on a large scale. There is no practical objection against accepting the results, because the chemist has discovered organic matter in the boiled water. It is not the amount of such matter, as it exists in soup, for example, which is injurious. The danger lies in the fact of putrescence, and this is arrested for the time by boiling. But if the experiment were perfectly successful, it could never justify the proposal in the Report to substitute it for the introduction of wholesome water to every town and village in the Presidency.

36. On the subject of local causes we find the usual intermingling of important facts with quite useless theoretic matter. In sanitary work we can only spend money on observed facts, and these which are given are sufficient to justify outlay both of money and effort. Take, for example, the case of Burdwan, which has suffered for years from fever. In this district 89 per cent. of the villages yielded fever deaths in 1882. The magistrate states that "village sanitation is still in a very back-"ward state; although the interior of the dwelling-houses in the mofussil are tolerably clean, the "surroundings thereof are in a most filthy state; cesspools, tanks overgrown with weeds and noxious "vegetation, and ashpits in which the sweepings of the cow-houses and decomposed vegetable matter "are thrown, abound in almost all rural villages. Persuasion and advice have failed to secure im-"provement. It is very difficult to induce the people to attend to the sanitation of their own villages, "and the zemindars, except in one or two instances, have done very little to improve the sanitary "condition of their tenantry." The only remark called for by this statement is, that the case as described is precisely one of those in which the authority of Government should be called in to grant competent powers for dealing with villages and zemindars, and to see thereafter that the work is effectually and continuously carried out. What defence is possible in face of the fact that the registering circles had 2, 3, and 4 per cent. fever death-rates—one of them, indeed, 43·75 per 1,000—and of this other fact, that since the previous census, Burdwan district had lost 92,027 of its population?

37. The villages in Bankura district appear to be even in a more unfortunate position. In one thana the fever death-rate was 46·00 per 1,000, and 48 per cent. of the district villages suffered. "In the town of Kotulpore the disease assumed a virulent type from the beginning of July. This "town was in a filthy condition, containing many stagnant pools, refuse and cow-dung pits, and "loathsome ditches, while the banks of tanks were freely used for the purposes of nature. . . . "People of all ages and conditions suffered from fever, and in many villages the entire population "was prostrated. . . . Water for drinking and culinary purposes obtained from tanks which "have not been cleaned for years, polluted by all sorts of filth, their banks defiled by the village "people, whose excreta are left to be eaten away by pigs or dogs, or to drain away into the tanks. "Heaps of refuse and decaying vegetable matter deposited on the slopes of these tanks."

38. In some of the circles in Birbhum the death-rates from fever were as high as 3 per cent., and in one thana the rate was 87·64 per 1,000. In this case declining health, consequent on previous fever attacks, was observed, and that relapses, added to "the cachectic condition and low state of health of the people, induced by previous repeated attacks, caused the mortality to be heavy."

39. In Midnapore district "the local insanitary conditions, canal irrigation, and the filthy habits "of the people continued to be the same as usual, and no general or local sanitary measures were "effected which could have had the slightest effect on the general health. . . . The constitutions "of the people living within the epidemic area of Midnapore have become impressed by malarial "influence; cachexia, anæmia, and enlargement of the spleen, has become extremely common."

40. Fever in Serampore district is attributed to obstructed drainage, want of drainage, and impure drinking water.

41. With reference to the fever in Howrah district, the magistrate makes the following remarks:—"The large swamps, only a few miles from the town, are well known, and until they are drained "it is not likely that the health of the district will materially improve. . . . I do not know why "there is so much delay in proceeding with the work, which is of the first importance. The villages "are exactly as they were, and will remain so until the people get more educated, or the authorities "have greater legal powers." If additional legal powers are required, why should they not be given?

42. *Fever in Nuddea.*—Referring to fever in 1882, the Sanitary Commissioner makes the following remark on its prevalence in Nuddea:—"For the third year fever has prevailed pre-eminently and "and with most marked fatality in this district. The extent of the suffering may be gathered from "the following figures:—88 per cent. of the villages, against 90 per cent. in the preceding year, "suffered from the disease; 60,912 persons, or at the rate of 30·18 per 1,000, against 36·27 per "1,000, perished." In some of the thanas the fever mortality reached 4½ and 5½ per cent. of the population. The civil surgeon, in describing this fever, says that "it was mostly of an intermittent "nature, frequently degenerating into remittent. Some of those affected died of the first attack

" from intensity of the poison, while in those with whom it took a more chronic form, enlarged " spleen, jaundice, occasionally enlarged liver, dropsy, and general anæmia, concluded the fatal course " of the disease." In this district we are also told that "no zemindars have rendered any assistance worthy of notice in improving the health of the people."

43. Fever in Nuddea has been attributed partly to interruption of the natural drainages of the country by embankments, roads, railroads, &c., and the Government of Bengal appointed a committee, already referred to, with the view of arriving at the facts. Their report is appended to the present Sanitary Report for 1882, and we shall include its information in the remarks which follow. The southern boundary of Nuddea is about 25 miles north of Calcutta, and the district is traversed by rivers and watercourses. Its area is 3,404 square miles, and its population in 1881, including that of the towns, was returned at 2,017,847, or in the ratio of 592·79 per square mile. Its registered death-rate in 1882 was 39·37 per 1,000, and the preceding five years' average death-rate was 27·13 per 1,000. The death-rate from fever amounted to 30·51 per 1,000 for the country circles, while the five towns returned fever death-rates between 12·14 and 31·66 per 1,000. The five years' average fever-rate for the district was 21·96 per 1,000. This is a high average death-rate from malarial fevers and their complications, and it is subject to considerable augmentation in certain years. The object of the special inquiry was to ascertain the causes of these fever losses and to point out remedies, and a sum of 5,000*l.* was placed at the disposal of the committee to meet urgent cases. The whole country was traversed, and 400 villages were visited by the committee, together with the roads, embankments, &c., which had been partly blamed for the fever. But the very first paragraph of the report shows the existence of topographical causes of another kind of the utmost importance to the public health. This paragraph is as follows:—"(*a.*) The district of Nuddea is a vast alluvial plain intersected by " six large rivers, numerous smaller channels, and by a labyrinth-like network of forsaken river-beds " and old rivers in every stage of decay and effacement. It is dotted with lagoons and marshes, and " studded with numerous towns and villages, which are frequently hidden in clumps of bamboos and " clusters of trees. The lands are closely cultivated. As in all deltoid formations, the fall of the " country is away from the rivers, but the regularity of the slope is broken up by the tangle of rivers " and river beds which cross and recross one another, and obstruct the natural lines of surface " drainage." This description applies to a fever country, rendered so by its natural features, and it is obvious at a glance that it would be practically impossible to change its topography, depending as this does to a large extent on changes in the great rivers continually going on. The real question therefore is to determine whether there are any removable causes over and above those due to the natural topography, which could be so dealt with as to lessen the liability of the people to fevers. And first, as regards artificial obstructions to surface drainage, the committee point out that one entire section of country "which has been visited by the fever epidemic with special severity is absolutely free from artificial obstruction as far as we could ascertain."

In this section therefore there is no evidence of this cause having been added to those already existing. In the case of Eastern Bengal Railway the drainage obstruction was due not to want of water-way, which had been found sufficient previously, but to the bursting of a river embankment and overflow of the country, breaching the railway in several places. Additional water-way has since been provided.

In another section, where the fever mortality was not high, a khal had been closed by the State railway, "regarding which loud complaints were made to us, and apparently with reason." This is an instance of merely local obstructions, of which a number are given in the report, and their bearing on the public health fully discussed. They are mainly due to absence of sufficient water-way under lines of road or railway, and admit of easy remedy. No doubt defects of this class might affect injuriously the sanitary condition of a district, but the committee point out that their effect would be strictly local, while the Nuddea fever covers the whole area of the country in an epidemic form. They might aggravate the disease in specific instances, but could not originate a fever epidemic.

Their opinion may be quoted as follows:—"The general result of our own investigations shows " that there is very little obstruction to local drainage caused by the roads and railways in the district " of Nuddea, and that such obstructions as do exist are not of serious importance, except on the rare " occurrence of unusually severe floods. Further, we have found that on most roads where drainage " was obstructed in times past, bridges and culverts have been gradually provided, or breaches have " been made to allow the floods to pass, whilst roads recently made have generally adequate " water-way."

We have already alluded to the local topography of Nuddea, but to complete the history it should be stated that the topography is by no means a fixed quantity in the sanitary problem. The features of the country are, on the contrary, liable to change by the river forces, whose natural action is to raise the surface level of the country until this work is done, and the river has to find a course elsewhere, while the old bed is silted up and may become a disease cause. These changes are taking place all over the Ganges delta, and "the delta in Nuddea and Western Jessore has been " raised and practically completed, and by the gradual deposition of silt the line of drainage, which " was formerly from north-west to south-east, is now from north-west to south. In other words, the " work that had to be performed by the Bhyrub, the Cobaduck, the Nobagunga, and the Mysore-" Chitra has been completed and the rivers have died. In their place, the little Elankhali Khal has " opened out into the great Madhumati, and the Gorai has enlarged; the formative energy has been " carried at one bound from the west of the Jessore district to the east of it." In dealing with great nature forces such as these, mistakes have at times been made, and we are glad to see that the committee "consider professional advice necessary in most cases of construction and renewal of river embankments." This advice is equally necessary when opening up old river courses, and in

providing for the drainage of areas over which public works have to be carried, in order to obtain the largest amount of benefit with the least risk.

We have already shown the relation of rainfall to fever mortality for the whole of Bengal, and we shall here give the data for Nuddea district, where they are of special importance in connexion with the topography. The monthly death-rates from cholera in Nuddea are also added, to show how different is the influence of the amount of rain on the fatality of the two epidemics.

NUDDEA, 1882.

Months.	Deaths from cholera.	Deaths from Fever.	Rainfall.
			Inches.
January	710	8,629	·09
February	851	4,911	·48
March	2,257	4,822	·59
April	2,411	3,950	1·07
May	1,509	3,202	5·13
June	382	2,405	9·61
July	58	2,664	10·65
August	33	3,236	12·50
September	45	4,298	9·22
October	272	6,280	6·81
November	1,072	8,455	1·16
December	1,420	8,060	·04

Topographically, as we have said, Nuddea is essentially a fever country, and if there were no other fever causes than those connected with its drainage peculiarities, the problem which it presents would be almost insoluble; but it is an axiom in dealing with such cases everywhere that the natural defects of locality can be, to a very considerable extent, counterbalanced by adopting precautions in house-construction, local drainage, water-supply, cleanliness, food, air, clothing, all of which are necessary for improving the health and increasing the resisting power of the inhabitants against general insanitary topographical conditions such as those discussed in this Nuddea report.

Let us see then what information the Report gives us on this part of the question; and first, as regards water-supply, the committee make the following statements:—"The water-supply of Nuddea is of the worst possibly quality;" with exceptions stated, "there is no good water in the district. . . . The tanks are generally small, more or less silted up, and often choked with weeds." As a rule, "in and near villages their banks are broken, and they in consequence receive surface "drainage, while houses are in many places built near the edge of the water, into which they directly "drain. The water is thick and foul, greenish and brownish in colour, and contaminated with "animal and vegetable *débris*, sometimes also full of animal life, and completely covered with floating "vegetation. . . . . The old class of men who used to dig tanks, sometimes for the benefit of "the public, sometimes for the good of their own souls, are gone. They have been succeeded by a "generation who lack their faith. . . . . The consequence is that most of the old tanks are in "ruins and overgrown with noxious vegetation, and the number of new tanks is very small." This state of the tanks has been partly caused by the erection of embankments to prevent floods, which otherwise would have swept over the country and replenished them. The same tanks are also used for bathing, washing clothes, and other domestic purposes, and half-burnt bodies of the dead are thrown into water sources.

In many places the water is rendered unfit for use by the erection of weirs across the flow. Local water-supplies in villages appear to be unfit for use. Such water is never drunk if any other can be obtained. "The people dislike it very much, saying that it disagrees with them, and has an un-"pleasant taste. Considering that the wells are sunk in the foul soil of the village, sometimes within "a few feet of graves, it is not wonderful that the water should be bad. There is a cesspool, and in "some larger places a well privy, often in the immediate vicinity, from which percolation must take "place directly into the well."

The following remarks are made on the villages:—"Besides the deficiency and impurity of the "drinking water, we found still prevalent in the villages themselves every insanitary defect that "former observers had noted, defects that are more or less common throughout Bengal. The bad "condition of the land on which villages are built is brought about by the mode of construction of "houses and the habits of the people. In a country with a heavy annual rainfall, and subject to "inundation, the houses must be well raised. Earth is used for this purpose, and a homestead or "'bhita' thrown up, and on the top of this a house is built with a plinth of mud. This necessitates "the digging of an adjacent hole, often very deep, and always undrained. One homestead having "been formed in the manner above given, another and another is added without arrangement of any "kind, generally crowded together, until the whole village is honeycombed with such holes. These "receive every sort of household refuse, and nearly all the year round contain water of the foulest "description." In these hovels the poor people prefer sleeping on the floor, because from want of sufficient clothing, they find it warmer to do so than to sleep on raised beds.

Next, as regards conservancy. "Well or surface privies are erected in many a homestead without "a thought or a care as to how they are ever to be cleaned, while, from want of latrines or particular "localities set apart for the deposit of household or other filth and refuse, the roads and open "grounds, especially the edges of tanks, are fouled with the grosser forms of pollution. In the

" village of Alikdeah, near Chooadanga, we found it almost impossible to get down to the water in " one of the tanks, its banks both outside and inside were so covered with filth, yet the water of this " tank was being drunk. The mortality in this village was enormous. . . . Cattle dung is, as " a rule, never removed outside the village." It is thrown on to the roads, and left to rot and waste, while " there is a consensus of opinion among Europeans and natives that, except in the lower lands " used for the rice crop (amun dhan), reaped in the cold weather, there is a distinct decrease in the " fertility of the soil of Nuddea. Yet tons of the finest manure in the shape of cowdung are " available in every village, but this supply, which, if utilized by the cultivators, would restore " the fertility of their lands, is not only wasted, but is allowed to degenerate into a positive " sanitary evil." Again, "In the villages of Nuddea human beings and animals live in the " closest proximity, and overcrowding at nights is general in the huts, which, moreover, are un- " ventilated."

(*i.*) *Clothing.*—"The people seem as a rule to be badly supplied with clothing."

(*k.*) *Diet.*—"The diet of the lower classes is of inferior quality. Rice, with a small supply of poor " watery vegetable or dhall, and a little salt, is their daily fare."

(*l.*) To complete this most sorrowful picture, it remains to be said that out of 1,923,682 people inhabiting these Nuddea villages (in 1881), there died in 1882 no fewer than 10,936 from cholera, and 58,694 from fevers, affording a death-rate from these two diseases of 36·02 per 1,000.

(*m.*) We believe that a careful consideration of these facts can lead to but one conclusion in regard to these Nudden fevers, and this is, that, whatever may be the influence of local topography or climate on the public health, and whatever may have been the effect of those local drainage obstructions described in the Report, neither of these supposed disease causes would account for the facts, and, if this be true as regards Nuddea, there is every reason to believe that it holds equally true as regards the whole cholera and fever endemic area of Lower Bengal. There is no reason to doubt that malaria enters into the chain of causes, but the results are due to malaria and filth. Malaria is no doubt a general predisposing cause all over the Ganges delta, but it is a perfectly fair question to ask, would malaria produce these results, or anything like them, if the subjects of fever and cholera, the inhabitants of these villages, were endowed with sufficient stamina to resist malaria? Of course, the question implies its own answer.

(*n.*) But this inquiry is of importance in another direction altogether, because it raises the whole sanitary question in regard to the *modus operandi* of conditions under which the people within Dr. Bryden's endemic area live. It is impossible in the present inquiry to separate between malarial fevers and cholera as regards their causes. Statistical facts and local observations, such as are contained in the Nuddea report, prevent us from making any separation between the causes of these two endemic diseases."

The local facts all go to prove that the mass of the population live amidst surroundings by which their resisting power is impaired or destroyed, and of this malaria is the touchstone. Why a certain part of the people in 1882 should have died of the disease called "cholera," and why five times and upwards of this number should have died of "fever," while all were existing under precisely the same conditions, is a question we have no means of answering, unless we assume a close relation between the diseases.

(*o.*) Fortunately, for practical purposes it is not necessary to solve the difficulty, for it is certain from the facts that the same sanitary procedure is required to diminish the liability of the people to cholera which is required to diminish their liability to fever.

In the present state of the population it would, of course, be impossible to execute drainage works of such magnitude as would be required to remove the local causes of malaria in the Ganges delta. Wherever similar works have been carried out, they have been the result of long years of continuous and skilful labour. In the present case the committee recommend for Nuddea what appears to be the only feasible course, namely, to provide a remedy for observed local drainage defects. They give a list of defects of this kind in waterways, culverts, bridges, and the like, that came under their own immediate observation; but there can be little doubt that similar deficiencies in local drainage outlets exist more or less over all the low lands of the delta. The results of the Nuddea inquiry appear to show that providing for and keeping open of local drainages requires to be set on foot under professional advice, and to be subject from time to time to professional inspection. It need scarcely be said that all future railways, roads, &c., should be provided with sufficient water-way to prevent water-logging.

(*p.*) But if all improvements of this class were completed, the main fever and cholera causes would be left as they are. They have been fully described by the committee, and we concur entirely in their view that "all of them are within the immediate power of the people themselves to remove. . . . " . . . Under the guidance of Mr. Taylor," they say, "and his subordinates, a few villages have " tried to improve their condition by clearing jungle, forming burial grounds outside the villages, " raising subscriptions for the improvement of roads and drains, and in other ways; but very much " remains to be done," and they advise that "more power must be given to district committees, such " as is contemplated in the Bengal Government's letter, No. 9,212, dated 8th April 1882." And they conclude with the following hope, in which we most sincerely join, by saying, "We, however, feel " that it is sufficient for us to call attention to these sanitary defects, and to leave it to the experi- " ence of the magistrates and committees to frame such bylaws concerning them as may meet the " peculiarities of their respective charges."

So far as the facts in this special Report enable us to judge, the same remedies would be applicable to all fever localities in the delta, and the case is now in the hands of the executive authorities, who will henceforth be morally responsible for the health of the vast population over which they rule.

44. The amount of information about fever causes in the Nuddea Report renders it unnecessary for us to discuss at length the fever history of other districts, and we shall only notice such points as appear to throw light on the subject generally.

In Jessore, it is stated, that "no assistance has been rendered by zemindars and others by under-"taking sanitary works for the benefit of the people. And, moreover, that the fever in the district "was attributable to the obstruction of the natural drainage of the country for the purpose of growing "paddy."

45. The following hopeful fact is stated about the town of Rungpore: "The drainage operations "carried out in the marshes around the town of Rungpore have been of the greatest benefit. They "have removed to a considerable extent the hitherto extremely water-logged condition of the soil. "The scheme was commenced in 1877, and year by year, as the work progressed, a marked improve-"ment revealed itself in the health of the town."

In 1878 the death-rate of Rungpore was 34·22 per 1,000, and in 1882 it was 23·64 per 1,000. Its fever death-rate, 18·39 per 1,000, was still high.

46. But on the other hand, many villages and tracts (in Pubna district) are relapsing into complete jungle, owing to the locality becoming unhealthy.

47. At Darjiling there are imported fever causes of the following kind. Good houses are built with bad sanitary arrangements, and disease results. One case is given in which puerperal fever resulted from the state of the drains. Inspection of works is needed at all sanitaria in India for the prevention of disease causes of a totally different kind than those which afflict the native population.

48. In certain parts of Dacca fevers are increasing, on account of silting up of water-courses, consequent on changes in the direction of rivers and underlying clay subsoils.

49. "The town of Rajmehal is said to be a regular hotbed of fever, with its notoriously crowded "houses, stagnant tanks and pools of water, rank jungle, accumulations of filth and rubbish, well "privies, cesspits, &c." There is besides a large swamp in its vicinity.

50. These facts, taken from the reports, appear to give a sufficient account of the general fever causes in Lower Bengal and the nature of the required remedies. As already stated, the whole question must now be considered as having passed over from the sanitary inquirer to the executive authority. Again and again there is complaint that the zemindars will give no help to the people to help themselves; and so the evil will not only continue, but go on increasing year after year, unless the strong hand of the Government interferes to put an end to it.

In comparison with the losses from epidemics the losses from other death causes are of less importance, and are mainly due to the same sanitary defects. We shall, therefore, merely give the year's statistics under the usual headings.

51. *Bowel Complaints.*—Under this head were registered 61,362 deaths in 1882, of which 9,700 were returned from the urban, and 51,662 from the rural circles. The total death-rate was ·92 per 1,000. The monthly incidence of these diseases was as follows:—

Months.	Bowel Complaint Deaths.	Months.	Bowel Complaint Deaths.
January - -	5,217	July - -	5,727
February - -	4,286	August - -	5,985
March - -	4,675	September - -	5,125
April - -	4,452	October - -	5,021
May - -	6,042	November - -	5,230
June - -	4,860	December - -	5,637

These monthly numbers bear no marks of any relation subsisting between bowel-complaint mortality and climatic causes.

The deaths were returned from 23,670 villages out of 201,989 in the province, and from 623 registration circles out of 644.

52. *Injuries* gave rise to the following deaths in 1882:—

Suicides	Males - - - -	944
	Females - - - -	1,470
Wounds - - - - -		1,229
Accidents - - - - -		8,558
Snake-bite and wild beasts - - -		9,410
		21,611

It is worthy of remark that deaths from wild animals formed 43·54 per cent. of the total deaths from injury.

Under the head "All other Diseases" were classified 140,732 deaths, or 2·12 per 1,000 of the population.

53. *Port of Calcutta.*—Before concluding this account of the disease history of Bengal and its relation to local causes, we shall introduce a brief notice of diseases prevalent in the port of Calcutta.

The port population of the year is not distinctly stated. There appears, however, to have been a considerable increase in the number of European seamen, "for augmentation of marine trade brought 1,792 mariners to Calcutta in 1882 against 1,350 in 1881."

Among European sailors there were 41 deaths from cholera, stated to amount to 14·69 per 1,000, against 11·83 per 1,000 in 1881. In 18 of the attacks "it was known that drunkenness and exposure to rain and cold preceded the attack."

Fever cases and deaths among European sailors are stated as follows for 1882:—

Fevers.	Cases.	Deaths.	Deaths per 1,000.
Malarious fever - -	251	5	1·79
Simple fever - -	186	—	—
Enteric fever - -	8	6	2·14

There were among the same class 143 cases and 2 deaths from diarrhœa, and 146 cases and 8 deaths from dysentery. The death ratio for the former disease was ·71, and for the latter 2·86 per 1,000.

Among the native floating population there were 115 deaths from cholera, or 4·52 per 1,000; besides 26 deaths, or 1·02 per 1,000 from malarial fevers. The epidemic death-rates on the river were all higher in 1882, keeping pace in this particular with the greater severity of epidemic disease on shore.

54. *Sanitary works (Civil).*—Under this head are given returns of expenditure from 184 municipalities and unions in Bengal. The total amount available in 1882, including the past year's balances, was 310,673*l.*, of which 36·75 per cent., or in round numbers 100,000*l.*, was spent on sanitary works, against 23·93 per cent. in 1881. The increased sanitary expenditure in 1882 is in great part due to the removal of police charges from the municipalities, a step which enabled them to pay more attention to practical sanitary work.

The expenditure arranged under the usual heads stood as follows:—

Nature of Expenditure.	Per-centage of Total Income.	
	1882.	1881.
Conservancy and latrines - - - -	8·4	6·1
Ditto establishment - - - -	10·1	10·4
Drainage - - - - -	4·4	2·1
Water-supply - - - -	1·0	·95
Disposal of dead - - - -	·22	·19
Markets and slaughter-houses - - -	·45	·22
Vaccination - - - - -	·38	·33
Treatment of sick - - - -	4·0	2·5
Other sanitary works - - - -	1·8	1·1
Roads - - - - -	18·14	16·2

Considering the large population over which these charges are spread, the amounts are very small. The one satisfactory point shown by the table is that the expenditure on public health measures has been augmented. But except, perhaps, in some of the unions, the vastly superior village population is unrepresented in this abstract.

Appended to the Report is a list of places where sanitary works under the preceding heads have been begun or finished during the year. In many places public latrines and conservancy plant have been provided, and the practice of collecting and trenching sewage is being extended. Under this head it may be stated that Rungpore municipality has established a vegetable garden on a trenching ground, where English vegetables are grown and "freely sold to the public." This is an important work, and might be extended all over Bengal, and thus, while public health might be protected from an abominable nuisance, great additions might be made of the public supply of important articles of diet.

The following improvements have been carried out in five important bustees in the suburbs of Calcutta. These bustees "were reclaimed at a cost of Rs. 13,001. The improvements consisted in "the ground being levelled, broad roads constructed, good tanks provided, drainage improved, houses "removed and rebuilt in systematic order, arrangement made for the construction of future buildings "in regular lines only." Similar improvements are being carried out in Howrah, and a new station (Khoolna) was being properly laid out. This work is very important, for it is not only a beginning of a reform which must in time be extended, more or less, all over India, but it shows that the thing can be done. We are glad to see that several of the more prominent unhealthy local causes referred to in preceding paragraphs as connected with the epidemic history of 1882 were being dealt with by the

municipal authorities, and also that, notwithstanding the general complaints made of the inattention of zemindars to the interests of the people, there have been a number of cases where, together with local proprietors, they have executed real improvements.

Under the head of *Drainage* it is stated that "the great drainage scheme in the Lalbagh municipality in the Murshidabad district was almost completed at the close of the year," at an outlay of 3,291*l.*

In a considerable number of localities drainage works of greater or less extent were in progress, and "a good deal had been done" for Nuddea. In this fever-stricken district drainage improvements were in progress. One of these would, it was expected, improve the sanitary condition of a tract of country 20 miles long and a mile wide. Drainage surveys were in progress in several localities.

Water-supply.—Burdwan water-supply scheme had been undertaken. The Howrah scheme was under consideration, and also that for extending the Calcutta supply to the suburbs. In Pubna town a simple but important innovation in water distribution was introduced by the magistrate, who appears to have paid the cost. The neighbouring river was bunded, and a pump and iron cistern supplied, to "the great convenience of the people."

In Dushumga town 232 small tanks and 145 pools, &c., were cleared out, at the cost of their owners.

The "first sod" on the site of the new waterworks for Bhagulpore was cut by His Honour the Lieutenant-Governor in November 1881.

A long list is given of localities in which the water-supply was being improved by the excavation and cleaning out of tanks and wells, so that this most necessary work was making progress. But all of it taken together is a very small item in the general needs of the people.

55. Among the sanitary proceedings of the year was the extension of sanitary clauses of a number of Bengal Acts to municipalities and other authorities, to enable them to deal more effectually with local disease causes. One of the latest of these Acts (11, B. C., 1882) has an important bearing on the Nuddea case, and others like it. It confers power "for the better construction, maintenance, "and management of embankments and watercourses, the maintenance, alteration, or removal, &c., "of embankments, railroads, &c., which interfere with drainage, or of watercourses, sluices, &c., "which affect public health, and for preventing the construction of dams or other obstructions for "diverting or opposing the current of a river or watercourse whereon there are embankments."

If these powers are applied under proper engineering advice, they will enable a great disease cause in Lower Bengal to be removed. Another important Act relates to the better regulation of coolie traffic to labour districts, as regards medical examination, diet, clothing, comfort during transport (which should include efficient and wholesome shelter at night), regulation of labour, &c.

There is also an important Act (V., I.C., of 1883), bearing directly on the question of substituting sanitary measures on board ship in lieu of quarantine. It grants very extensive powers of inquiry, and will do much good in tending to keep crews and vessels healthy.

A Bill for extending local self-government in Bengal, with the special object of enlisting the services of natives in improving the sanitary state of the people, was under consideration.

We are glad to see that, in consequence of a recommendation made in a previous year's Memorandum, the floating population have been placed under inspection, for the discovery and treatment of diseases among them.

56. In compliance with Government orders, a set of rules has been issued for the guidance of vaccination officers, which include inspection and report on the "sanitary condition of villages, and "sources of insalubrity affecting the health of their inhabitants, prevalence of disease in epidemic "and other forms, topography, population, dwellings, roads and streets, water-supply, conservancy, "disposal of the dead, food, general health, steps taken to explain existing sanitary defects to the "people, and to induce them to abandon habits which tend to produce unhealthiness amongst "them." In the course of the year 1,292 villages were inspected and reported on. The number was very small when compared with the total of 201,989 villages in the province.

The defects found by inspecting officers were the following:—"Badly-constructed and ill-arranged "dwellings huddled together, no regard to space proportioned to the number of inmates or to the "free admission of light and air; narrow and ill-constructed roads, with still narrower and more "tortuous lanes and bye-lanes, unprovided with side drains, and useless as arteries for the circu-"lation of air: entire or almost entire absence of conservancy arrangements of any sort; defæcation "and micturition performed in any convenient place, human and animal excreta, together with all "kinds of domestic refuse, piled up and accumulating near houses; water drawn from any and every "source, regardless of pollution, and used for drinking and cooking purposes; banks of tanks, "rivers, and streams used by preference for all the purposes of nature; the water defiled by bathing, "washing of utensils or of vestments fouled with the excreta of the sick, the exudations of loathsome "skin diseases or the discharges of menstrual women; drainage either completely absent or else "defective and obstructed, or, if good, intercepted by bunds or other more noxious impediments; "excavations, dug indiscriminately in all kinds of situations, and allowed to become the receptacles "for every description of filth, or the basins of stagnant pools, &c." After alluding to the difficulty of making the people comprehend the importance of these conditions, the Sanitary Commissioner concludes with these words, "These people have lived the life of beasts from time immemorial, and they neither know of nor care for any other."

Limited in number as these inspections have been, they have nevertheless removed any obscurity which may have previously existed in Lower Bengal on the subject of local disease causes, and when we place with them the other fundamental fact that the descriptions refer to a vast population spread over the deltas of great rivers, the whole areas of which are either without drainage or are subject to

floods and residual stagnant water, we seem to have arrived at an explanation of the reasons why this great province has obtained the name of the "endemic area" of India, and as regards cholera, of the endemic area whence spreads this pestilence over the world.

57. Apart from all etiological theories we have the evidence of statistical facts, imperfect as these may be, to show the constant elaboration of epidemics within the delta areas, and their great augmentation in severity from time to time, leading, as it were, to overflows from the breeding ground into countries far away from its vicinity. Together with this experience, we have in the present Report a fearless exposure of the local conditions under which the subjects of these epidemics, the people, pass their lives, until increasing predisposition leads to their decimation by cholera or fever, or both, when the next epidemic crop has to be reaped. We have, moreover, the statement that these causes are known and are removable, and that they are not removed, and herein we have the key to the whole Bengal sanitary problem. It is a case of mere *inertia*. The facts are known and admitted by people, medical officers, Sanitary Commissioners, magistrates, and by the Government itself in its resolution on the present Report.

The case is so fully discussed that we scarcely see our way to making any recommendations which do not already exist, in some form or other, in the Report itself.

It would at the same time be unfair not to acknowledge fully the disposition to improve the sanitary condition of the people which the present year's Report exhibits in good work done, and legal powers granted for doing more. But we fear that little of the work touches the core of the question which this and all previous Reports show to lie in the Bengal villages, for it is in them and nowhere else that the epidemic question must be grappled with. If we may suggest any order of procedure, we should feel disposed to advise the cleansing, conservation, and regulation of tanks and wells, filling up of those unwholesome village excavations, removal of local defects in drainage, and the adoption of some rules for village conservancy. All this would be within the sphere of practical work, and could mostly be done village by village, and by the people themselves.

As the Nuddea case has been so fully reported, we would suggest whether special effort might not be directed towards the improvement of this district.

In conclusion, we express our acknowledgments to the reporters who have supplied the materials for this valuable Report, and to Dr. de Fabeck, Professor of Hygiene in the Medical College, Calcutta, who acted as Sanitary Commissioner while Dr. Lidderdale was otherwise engaged.

19th July 1884.

No. 5.

MEMORANDUM of the ARMY SANITARY COMMISSION on the REPORT of the SANITARY COMMISSIONER for the PUNJAB for 1882.

1. The vital statistics of the Punjab for 1882 are based on the census enumeration of 1881, which yielded the following results, exclusive of the population of Khaibar Pass, 8,173 in number, which is not under registration.

The census numbers were, of—

Males	10,210,053
Females	8,640,384
Total	18,850,437

These numbers, which are presumed to yield returns of births and deaths, include the cantonments, but the births and deaths among the cantonment populations are not included in the provincial returns, and hence the ratios are a shade under the truth, but the difference is so small as not to affect perceptibly the year's rates. The cantonment population varies between 200,000 and 250,000. The census population of 1868 was 17,611,498. There was hence an increase of population in the 13 years' interval of 1,238,939.

2. The births registered in 1882 were, of—

Males	371,136
Females	319,388
Total	690,524

The birth ratio was 36·65 per 1,000 living. It was almost the same in urban and rural districts, having been 36·4 in the former group and 36·7 in the latter. The rate for England and Wales for 1876–80 was 35·4 per 1,000. The Sanitary Commissioner says that on the whole he is quite satisfied with the progress which has been made in birth registration, but still there appears to be some explanation required of the fact that the census enumeration of 1881 showed an excess of males over females of 1,569,669 living.

3. Deaths in 1882 were returned of—

Males	271,018
Females	233,781
Total	504,799

The death-rate for males was 26 and for females 27 per 1,000. The provincial rate was 27 per 1,000. Either female deaths are less completely registered than deaths of males, or infant life is more liable to fatality among males.

Similar problems in vital statistics have presented themselves all over India, and they would apparently justify a recommendation that their causes should be investigated.

4. As we now have the population and registration data for the whole province, it may be useful to introduce the following abstract for all districts:—

Districts.	Area in Square Miles.	Population, 1881.	Ratio of Births per 1,000.	Ratio of Deaths per 1,000.	
				1881.	Previous Five Years.
Delhi	1,276	643,515	40·34	31	45
Gurgaon	1,938	641,848	35·90	27	44
Karnal	2,396	622,621	40·99	32	40
Hissar	3,540	504,188	37·25	20	25
Rohtak	1,811	553,609	39·08	26	36
Sirsa	3,004	253,275	34·61	20	27
Umballa	2,570	1,067,263	32·40	27	30
Ludhiana	1,375	618,885	37·51	23	31
Simla	18	42,945	11·20	16	22
Jullundur	1,332	789,555	39·62	24	37
Hoshiarpur	2,180	901,381	37·95	24	31
Kangra	9,069	730,845	30·01	27	27
Amritsar	1,574	893,265	38·50	27	39
Gurdaspur	1,892	823,695	41·66	26	28
Sialkote	1,958	1,012,148	44·73	24	23
Lahore	3,648	924,106	36·89	28	37
Gujranwala	2,587	616,892	43·38	24	29
Ferozepore	2,752	650,519	37·30	22	28
Rawul Pindi	6,218	820,512	34·73	31	36
Jhelum	3,910	589,373	33·71	33	29
Gujrat	1,978	689,115	42·48	21	26
Shahpur	4,691	421,508	41·02	40	27
Mooltan	5,880	551,964	32·89	36	26
Jhang	5,702	395,296	42·36	33	15
Montgomery	5,574	426,529	33·61	23	24
Muzaffargarh	3,139	338,605	41·38	45	28
Dera Ismail Khan	9,296	441,649	30·79	31	23
Dera Ghazi Khan	4,517	363,346	21·37	28	16
Bannu	3,368	332,577	31·31	26	22
Peshawar	2,504	592,674	18·91	17	21
Hazara	3,039	407,075	38·02	24	20
Kohat	2,838	181,540	21·71	12	15
Total for the Province	107,989	18,842,264	36·65	27	30

5. The average population per square mile for the whole province in 1881 was 175, but it varied greatly in different districts. The most sparsely peopled districts were Dera Ismail Khan and Kohat, which had 47 and 64 inhabitants per square mile, and five years' average death-rates of 23 and 15 per 1,000 respectively. The highest density, 2,386 per square mile, was presented by Simla, of which the five years' death-rate averaged 22 per 1,000. Out of 32 districts 10 had densities of population less than 100 per square mile.

6. The census enumeration has enabled the following death-rates to ages to be deduced. They are calculated on the numbers living at each age.

Ages.	Total Deaths.		Ratios per 1,000.	
	Males.	Females.	Males.	Females.
Under 1 year	77,261	67,051	238·56	217·97
1 to 5 years	40,061	43,977	51·14	49·41
5 „ 10 „	12,979	11,152	9·13	9·91
10 „ 15 „	6,911	5,779	5·56	6·29
15 „ 20 „	5,594	5,098	6·17	6·89
20 „ 30 „	16,617	16,212	9·08	10·51
30 „ 40 „	16,512	15,573	11·98	13·33
40 „ 50 „	20,830	15,980	20·73	18·46
50 „ 60 „	26,992	14,664	31·60	28·12
60 and upwards	46,261	38,295	78·27	78·46

We learn from this table that out of 692,534 children born in 1882 there were 144,342 deaths under one year of age, and that under five years 236,350, or about 34 per cent. of those born, had died.

7. The population, deaths, and death-rates among different classes were as follow:—

Classes.	Population.	Deaths.	Death-rates per 1,000, 1882.
Mahomedans	10,522,802	286,315	27·21
Hindus	8,288,575	177,029	21·37
Christians	32,500	37	Ratio uncertain.
Other castes	3,387	41,418	—
Total	18,842,264	504,799	26·79

It will be seen that the deaths of "other castes" greatly outnumber the population, because the local registrars have included in the column of deaths those due to Mahomedan and Hindu sweepers, a classification referring to occupation rather than to class. This will be rectified in future.

There are in the Punjab 28,677 Europeans and Eurasians, among whom registration appears to require looking after, as the recorded birth and death rates amounted in 1882 to 3·56 per 1,000 and 3·06 per 1,000 respectively.

8. The death-rate divided between the population of 32 country districts and 49 towns gives the following results:—

Population.	Death-rates per 1,000.	
	1882.	Five Years' Average.
Districts, 17,512,378	26	29
Towns, 1,310,383	33	47

Both ratios show improved health.

9. *Death causes in* 1882.—The following were the registered causes of death under the usual headings:—

Diseases.	Total Deaths.	Deaths per 1,000 of Population.
Cholera	39	0·002
Small-pox	6,379	0·340
Fevers	346,674	18·400
Bowel complaints	15,965	0·850
Injuries	4,753	0·300
All other causes	129,989	6·900

10. The year's disease history presents some points of considerable importance which require notice. The Sanitary Commissioner has given a chart showing the monthly prevalence of cholera since January 1867, of which the following figures are the annual totals:—

Years.	Deaths from Cholera.	Years.	Deaths from Cholera.
1867	43,146	1875	6,246
1868	532	1876	5,736
1869	9,258	1877	29
1870	469	1878	215
1871	369	1879	26,135
1872	8,727	1880	274
1873	148	1881	5,207
1874	78	1882	39
Totals	62,727	Totals	43,881

This abstract gives the statistical history of Punjab cholera for a period of 16 years, and one result follows from the facts, namely, that up to the present time we have no means of accounting for them.

No theory of cholera germs, cholera poison, personal contact, commercial intercourse, railways, insanitary surroundings, bad water, or climatic peculiarities throw the smallest light upon the facts.

The intensity and fatality of the disease in each year is governed by some other factor, and this mere waste of time and effort to try to explain them on any series of suppositions, however plausible these may appear to be, while it is positively injurious to the best interests of the public health to assume that because some one thinks that he has observed a distinct case of causation, therefore this case can be usefully made to include all other cases, whether a cause was or was not observed.

We can, however, from the facts as they stand, deduce certain important practical lessons. The years 1867 and 1879 were Hurdwar fair years, but they were also years of severe cholera prevalence in regions of India beyond the fair influences. The assemblages at Hurdwar involved added insanitary factors of well known evil repute under such circumstances, namely, fatigue, crowding, filth, impure water, and waning excitement, and no doubt the Hurdwar fair years show the highest death-rates in the series. Hurdwar itself presents considerable local difficulties to the sanitary improver, and as the conditions depend to a large extent on local topography, the question to be solved in any given case is, whether the site admits of being kept in a wholesome condition with a great crowd of pilgrims and animals. If this cannot be done, the advent of cholera in an epidemic year may be anticipated, and this presumption points to suspending the fair, or to limiting the numbers resorting to it. But while saying this, it must be stated that holding of fairs at Hurdwar has been quite safe with limited numbers and efficient sanitary work.

Now, all this can be done without complicating the work of civil officers by the introduction of hypothetical causes, which up to the present time have not been proved to exist, far less to be efficient.

Another important lesson taught by the table is that the mortality from cholera, which in the first eight years of the series had been 62,727, had declined during the second eight years to 43,881, showing apparently the influence of sanitary work on the mortality. But the law of cholera prevalence which is of most practical importance is the great oscillation in cholera mortality, and, as our only known means of coping with this feature of the epidemic is cleanliness and pure water, these should be strenuously pursued during seasons when mortality is lowest, so as to diminish the risk of increase when the years of greater epidemic intensity come round.

11. We shall next show the relation which existed between the Hurdwar fair of 1882 and the Punjab cholera of the same year. And first, the following abstract shows the monthly deaths from this disease in 1882:—

Months.	Deaths from Cholera.	Months.	Deaths from Cholera.
January	3	July	8
February	5	August	6
March	2	September	4
April	3	October	8
May	6	November	1
June	2	December	1

All cholera deaths of the year were recorded in 28 registration circles out of 446 in the province, and only 30 villages out of 34,973 furnished the whole mortality.

Hurdwar fair was held between the 6th and 16th April, and was attended by 100,000 people, the daily average having been 60,000. Every care was exercised to preserve the whole locality of the fair free from impurity, and ample provision was made for the immediate discovery and treatment of premonitory cases. The Sanitary Commissioner of the North-West Provinces and the civil officers were on the spot to see that nothing was neglected. There was not a single case of cholera due to the fair or in its neighbourhood, and, as the table shows there were only three deaths from cholera in the Punjab during the fair month. Experience, therefore, leaves us with the following results, so far as the fair is concerned:—1st, the best attainable sanitary arrangements for 100,000 pilgrims; 2nd, a moving cholera of low intensity; 3rd, complete immunity of these pilgrims from cholera. There was only one choleraic case in a pilgrim apparently imported.

12. In 1882 cholera first appeared in the vicinity of Delhi in January, and moved in a north-west direction. We had thus the presence of cholera and its movement in time and space, and the fair was held close to the line of movement. The one circumstance which distinguished this cholera was its very low intensity, as shown by the small number of deaths, but the disease was there, and ought to have spread in conformity with "germ" or "contagion" law had these been the only factors in the case. Sanitary defects and impure water sources in towns and villages were the same as they had been. Why then was there so little cholera in the province? This question is far too important to be replied to by putting forward any theory. The reply must either be a fact or a confession of ignorance. So far as the actual data lead us, all we can say is that they belong to a class of which the experience has been constant. It needs no further proof to show that the history of Punjab cholera has been one of cyclical increase and diminution connected with the greater or less number of population groups attacked, and with the greater or less number of deaths in each attacked group. This is the historical fact, and as we know, from very large experience, that cleanliness and pure water are the main practical steps at our disposal for diminishing the number of local attacks in all stages of intensity, we arrive again at the practical conclusion that sanitary work should be at all times depended on as the real protection against epidemic cholera anywhere. The mere facts of the case show that cordons and all similar quarantine measures are quite useless, simply because in a country subject to epidemics these diseases are behind as well as before any possible line of cordons,

and cordons presuppose passage of people from affected to unaffected centres at specific times, an event of very rare occurrence. But the great danger of trusting to cordons for protection lies in the fact that the only known means of protection, sanitary measures, are neglected or set aside, and our most recent experience, that of the affected towns in Egypt, has taught us with what results, for even at the last moment people were shut up on polluted town sites to perish by hundreds, instead of being removed bodily away from them as the only present means of saving life. The people perished in obedience to a theory.

13. *Small-pox.*—Epidemic small-pox is a far more formidable and fatal disease in the Punjab than cholera has been. This is well shown in the following abstract of a chart given by the Sanitary Commissioner in the present Report :—

Years.	Deaths from Small-pox.	Years.	Deaths from Small-pox.
1868	23,759	1876	10,254
1869	53,195	1877	12,296
1870	27,163	1878	40,271
1871	25,534	1879	49,489
1872	23,728	1880	9,145
1873	25,699	1881	6,749
1874	12,026	1882	6,379
1875	13,594		

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Comparing the same 15 years, 1868—1882, for the two diseases, the deaths have been as follows :—

Cholera	63,462
Small-pox	339,281

For every death from cholera there have been upwards of five deaths from small-pox within these years. It is, however, satisfactory to find that there has been a considerable reduction of small-pox mortality of late years, for, if we divide the 15 years' data into two periods of 7½ years each, the table shows that in the first period the deaths amounted to 197,901, and during the second to 141,380, showing a saving of 56,521 lives. It will be observed also that the return for 1882 shows the lowest mortality of the series. The great outburst of small-pox in 1878–79 corresponds to the famine augmentation of small-pox mortality in Southern India.

The next abstract shows the monthly deaths for 1882.

Months.	Small-pox Deaths.	Months.	Small-pox Deaths.
January	358	July	744
February	334	August	568
March	408	September	286
April	682	October	165
May	896	November	207
June	1,104	December	728

Of 32 registration districts, Simla alone returned no small-pox deaths. Out of 446 registration circles, 297 registered deaths, but when we come to the villages the usual anomaly is presented of all the deaths having taken place among a few groups of population only. There are 34,973 population groups, of which 1,777 yielded all the small-pox mortality.

Of 49 towns, having a population of 1,310,383 persons, 32 returned 1,743 deaths, or 1·33 per 1,000, while the country circles, including 17,512,378, returned 4,635 small-pox deaths, a rate of 0·26 per 1,000. The conjoint rate for the whole province was 0.34 per 1,000.

14. *Vaccination service.*—Within the last year or two the vaccination service in the Punjab has been reorganized, and the work is now carried on by district, special, and cantonment vaccinators.

The district staff in 1882–83 included 27 supervisors, 40 first-class vaccinators, 67 of the second class, and 149 of the third class.

The total primary vaccinations performed by this staff were 464,886, and of re-vaccinations 2,331. Of primary vaccinations 442,315 were successful, and of re-vaccinations 1,070.

Vaccinations performed by the special staff numbered 29,507, of which 27,912 were successful. Of re-vaccinations, 274 in number, by this staff, 118 were successful.

In cantonments 2,407 individuals were primarily vaccinated, of which 2,296 were successful, and of 292 re-vaccinations 216 succeeded.

The year's returns were not complete at the date of the Report, but a sufficient idea of the year's work and its probable influence on small-pox mortality may be obtained from the following summary :—

Total year's births	690,524
Total small-pox deaths	6,379
Of these under one year	1,481
Total successful primary vaccinations	472,523
Of which under one year of age	354,414

More than half the children born were vaccinated, which, under the circumstances, was good work, and it will be seen that 76·4 per cent. of the small-pox mortality of the year took place at ages exceeding one year. The data are, of course, limited to one year, but, with so large an amount of vaccination work in hand, we should naturally expect considerable saving of infant life.

This subject is otherwise of a departmental character, and very full details are given about the year's proceedings.

15. *Fevers.*—In 1882 no fewer than 346,680 people died of fever in the Punjab. The fever death-rate was 18·50 per 1,000, less, however, than the previous five years' mean, which was 20·77 per 1,000.

The annual fever deaths for a period of 15 years, as given in the fever diagram, have been as follows:—

Years.	Fever Deaths.	Years.	Fever Deaths.
1868	151,337	1876	351,286
1869	272,946	1877	219,231
1870	275,093	1878	440,492
1871	213,548	1879	472,939
1872	264,711	1880	322,727
1873	219,909	1881	355,279
1874	190,631	1882	346,680
1875	279,825		

The mortality from cholera and small-pox are small matters when compared with the figures in this abstract. The two years of highest mortality, 1878, 1879, were years of scarcity and high food prices, but, even disregarding these two years, it is evident that deaths registered as due to fevers have largely increased of late years.

In 1882 every district in the Punjab returned fever deaths, and all the registration circles, 446 in number, registered fever deaths, with a single exception in Hazara district. But nothing can show more clearly the universality of fever than the fact that, out of 34,973 population groups, 28,818 suffered.

The fever death-rate in the country circles was 18·50 per 1,000, and in the 49 towns it was 17·14 per 1,000.

Fever death-rates exceeding 20 per 1,000 were registered in the following districts:—

Districts.	Fever Deaths per 1,00 of Population.
Karnal	20·89
Jhang	22·15
Rawul Pindi	23·62
Dera Ghazi Khan	24·81
Dera Ismail Khan	25·08
Jhelum	25·68
Mooltan	27·60
Shahpur	28·47
Muzaffargarh	37·95

Similar differences showed themselves in the town registration. In 11 towns the fever death-rates exceeded 20 per 1,000.

In Find Dadan Khan, out of a population of 16,724, there were 672 fever deaths, and in Bhera 816 died out of a population of 15,165. In the former town the fever death-rate exceeded 4 per cent., and in the latter 5 per cent. of the population.

16. The incidence of fever mortality by months was as follows:—

Months.	Fever Deaths.	Months.	Fever Deaths.
January	27,661	July	18,202
February	19,093	August	21,480
March	20,129	September	31,634
April	18,656	October	42,293
May	23,046	November	51,269
June	22,642	December	50,619

In discussing the climatic causes of fevers in the province, the Sanitary Commissioner has given tables and diagrams to show the relation of fever mortality to rainfall, but as the aggregate fall at all the observing stations, both for months and years, is used in the comparison, the results are scarcely of a very exact nature.

The number of annual fever deaths does not always correspond with the aggregate rainfall of the years, neither do the monthly fever deaths correspond with the monthly aggregate rainfall; but there

is an important general feature, which recurs year after year, and thus establishes a relation between rainfall and fever mortality, and it is this. The great rainfall in each year begins in July and lasts through August and into September, after which there is not much rain, but there is drying up, accompanied with variable temperature and cold. In September the fever mortality suddenly rises, and continues high till the end of the year and into the month of January of the year following. The large increase of rain in July does not augment the fever mortality of that month, but its effect is obvious enough in the subsequent months.

Reverting to the preceding abstract of monthly fever mortality, it will be seen that during the first six months of 1882 there were 131,227 deaths, and during the last six months 215,453 deaths were registered. During the first six months the aggregate rainfall at all the observing stations was 119·4 inches, figures which are only useful as affording a means of comparison. In the next three months, July, August, and September, the great rainfall of the year took place, yielding the high aggregate of 646·1 inches. As a matter of fact, the rainfall in these three months was nearly 5½ times the amount which fell in the first half of the year, and the fever deaths were 71,266. During the last three months the entire aggregate rainfall was only 2½ inches; in other words it was *nil* so far as regards fever, but these were the drying up and variable temperature months, and they yielded 144,187 fever deaths. These facts, recurring year after year, as the Sanitary Commissioner has shown that they do, lie at the foundation of fever etiology in the Punjab.

Districts and population groups along the course of rivers suffered most from fever in 1882, due to rise in the water-level, flooding, back-watering of the subsoil, and consequent reproduction of marshy malarial conditions.

In the case of Pind Dadan Khan, with its 4 per cent. fever death-rate already mentioned, "the "water came up round the city, and entered the streets and lanes, in some places to a depth of "over two feet. All the low ground from Jhelum along the river was swamped, and fever necessarily "supervened."

The five per cent. fever death-rate at Bhera arose from a similar cause. The loss of life was due entirely "to heavy and repeated floods caused by repeated freshets in the Jhelum river, which "inundated the district, and, when the water receded, swamped all the low localities which surround "most Indian villages and towns, leaving marshes and hollows full of green water. These floods "have also brought the springs to a high level, and the sun still being warm in the day, the mornings "and evenings are cold. And these sudden changes, together with the air being charged with "malaria, is (in the opinion of the Deputy Commissioner) the chief cause of this serious outbreak of "fever, from which neither Europeans nor natives have escaped."

There appears to have been no scarcity of food to aggravate the liability to fever, and Europeans also suffered. Generally, food prices appear to have been lower than of late years.

The whole subject appears to have been fully inquired into by order of the Government, especially in the flooded districts, where, from local circumstances, there were added fever causes beyond those from which the province suffered as a whole. It is important, however, to quote a fact stated by one of the deputy sanitary commissioners, who says that in one village where there was fever the flood did not come within two miles of it, while the fever broke out simultaneously over a large tract of country, but "the severity of the outbreak was directly proportioned to the floods."

17. The fever was simply malarial fever chiefly quotidian, in some cases attended by vomiting and purging. The fever usually lasted from 7 to 10 days.

The registered fever deaths in 53 villages for August, September, October, and 25 days in November afforded the following interesting facts:—

Deaths.

Males	299
Females	318
Total	617

Ages of Death.

1 year and under	298
2 to 5 years	115
6 to 20 years	42
21 to 49	48
50 and over	114
Total	617

About 67 per cent. of the total fever mortality took place at and under five years of age, and 98 of these deaths took place in infants at and under one month old.

Facts of this class point not only to the influence of malaria in causing fever, but to the effect of predisposition or liability to attacks manifested in infant life, and due to a large extent to want of suitable clothing, protection, and care at susceptible ages. The case, as a whole, is well put as follows. Referring to a district which suffered severely, the Deputy Sanitary Commissioner says:— "Everywhere in the area traversed I found the existing causes of the prevailing sickness to be in a

" change of the climate produced by inundations and water-logging of the soil in the river valley, " rendering the air of the country unusually damp, and subject to chills with the alternation of night " and day temperature, whilst the predisposing causes were due to the defects in the sanitary sur- " roundings of the people and to unfavourable conditions in the material prosperity of the labouring " classes, mainly in respect to their being altogether insufficiently clad, and in respect to their poverty " rendering them incapable of improving this unfavourable condition without aid of a charitable " kind."

18. The insanitary surroundings of the people referred to are those usually found among Indian village populations, and consist of unremoved village filth, and contaminated water as a consequence of it. The Deputy Sanitary Commissioner says: "Without exception, I found all the villages visited in my tour in a very filthy and neglected state of conservancy;" and he advocates the introduction of village conservancy rules in this district. This, of course, can be done, and should be done at once. There is now no reason why every village in the province should not be once for all cleansed, and afterwards kept clean.

In districts liable to periodical flooding, the only remedy must be found either in removing the population beyond the influence of the water, or, in local drainage works, to relieve the surface and subsoil of water as quickly as possible when the river falls. Fever is sure to follow if there are places where the flood-water has to remain until it is dried up by evaporation.

The practical conclusion stated by Mr. Bellew appears to include the main principles to be kept in view in dealing with these fevers. He says:—"The cause of sickness and death from these malarious " fevers is, to a great extent, preventible by an efficient drainage of the soil and precautions in the " matter of habitation, clothing, and food. In proportion as these matters are attended to, and " exposure to 'chill' provided against, not only by the adoption of suitable sanitary measures for the " welfare of the general community, but also by attention on the part of the individual to ordinary " precautions of personal protection from exposure to this most common cause of sickness in such " localities, namely, to 'chill,' the result of exposure in an unprotected state (whether from unsuitable " clothing, faulty housing, or deficient food) to the alternations of temperature and humidity in the " course of night and day, so will the rates of sickness and death diminish."

One practical result of the experience is that cheap and suitable clothing is nearly as much required to enable a population to bear up against malaria and its fevers as is cheap and suitable food. Better drainage, improved agriculture, better housing (which might very well be made an object by the Indian sanitary service), strict attention to cleanliness and keeping clean, good water, cheap clothing, and cheap food, include the remedies of which Government might take cognizance in the general administration of the country. They all form part of the great end of all government, namely, improvement and civilization of the people, which includes under it the prevention of disease.

19. Intimately connected with the relation of natural flooding to fever mortality is the relation which fever mortality bears to irrigation, which is in reality artificial flooding, because the essential fever-producing condition in both cases is water-logging of the subsoil and consequent stagnation.

But irrigation is so intimately related to the food production in certain districts, that there has been a not unnatural disposition to doubt this view of fever causation, and the Government of India in 1875 directed a special statistical inquiry to be made into the death-rates in irrigated districts close to the West Jumna Canal. For this purpose 25 villages, with a population of 27,983, were selected in Delhi district, and 23 villages, with a population of 15,153, in Karnal district.

The results for four completed years have been as follows:—

	Death-rates per 1,000.			
	1879.	1880.	1881.	1882.
Delhi Villages - - -	65	47	58	46
Karnal Villages - - -	76	44	41	37

These rates are very high, and greatly exceed the average for the province, which was 27 per 1,000 in 1882, and 29 on the previous five years' average.

The following was the average death-rate of both groups of villages for the same years from fevers:—

Population.	Fever Deaths per 1,000.			
	1879.	1880.	1881.	1882.
43,136 - - - -	54·4	35·8	37·7	31·

These fever-rates also compare unfavourably with the average rate for the whole province for 1882, which was 18·40 per 1,000, and 20·77 per 1,000 for the previous five years. The inquiry is still incomplete, but the result is against irrigation without drainage.

20. *Bowel complaints.*—Deaths registered under this title are chiefly diarrhœa and dysentery, the mortality from which in 1882, namely, 15,960 deaths, was the smallest hitherto recorded. During the last 15 years "bowel complaints" have yielded the following annual mortality:—

Years.	Bowel Complaint Deaths.	Years.	Bowel Complaint Deaths.
1868	17,828	1876	27,271
1869	30,953	1877	17,664
1870	27,249	1878	32,071
1871	21,678	1879	29,612
1872	28,345	1880	20,736
1873	19,640	1881	17,281
1874	16,407	1882	15,960
1875	27,550		

Deaths from "bowel complaints" were registered in all the districts and in all the towns of the Punjab in 1882; also in all registration circles, 446 in number, with 28 exceptions. But, as usually happens, only a limited number of population groups (5,045 out of 34,973) returned deaths under this head. The death-rate was 0·85 per 1,000 against a previous five years' average of 1·34 per 1,000. It was highest in the towns, viz., 2·46 per 1,000. In the country districts the rate was 0·72 per 1,000, showing either better registration in the towns or more powerful local disease causes, probably the latter, as the town death-rates vary far more among themselves than the country rates. The lowest town rate of the year was at Lahore, namely, 0·58 per 1,000, and from this ratio the proportions mount up until the highest rate, 5·26 per 1,000, is reached at Palwal.

The lowest country rate was 0·18 per 1,000 at Peshawar; the highest, 2·48 per 1,000, was at Simla. Only four district rates exceeded one per 1,000.

The monthly distribution of bowel complaint mortality for the whole population was as follows:—

Months.	Bowel Complaint Deaths.	Months.	Bowel Complaint Deaths.
January	1,074	July	1,158
February	726	August	1,609
March	814	September	2,019
April	954	October	1,878
May	1,366	November	1,660
June	1,137	December	1,565

The deaths were most numerous during the second half of the year, but culminating in September, when heat and moisture after rain were present at the same time.

21. *Injuries.*—Under this denomination were recorded the following violent deaths:—

Suicides:

Males	126
Females	181
Total	307

Of these deaths 121 were from drowning, 114 from hanging, and 26 from poisoning by opium. The district of Gurgaon furnishes the largest number of suicidal deaths. It is stated that "on the slightest provocation" the women in this district are prone to throw themselves into wells.

Accidental deaths numbered 3,965, of which 2,080 were from drowning. Deaths from snake-bite were 1,014. There is a tendency to increase in this death cause, as may be seen from the following annual numbers of snake-bite deaths:—

Years.	Deaths.
1877	830
1878	752
1879	818
1880	968
1881	1,012
1882	1,014

The proportion of deaths from this cause differs greatly in different districts.

This is shown by a five years' table for all districts, which has also a column showing the total five years' death-rate per 100,000 from snake-bite. The lowest five years' rate was 0·7 per 100,000 for Peshawar district. The following districts gave the highest rates:—

Districts.	Total Five Years' Ratio of Deaths from Snake-bite per 100,000.
Lahore	9·8
Jhang	10·6
Shahpur	10·7
Montgomery	11·7
Muzaffargarh	12·4
Gujranwala	13·6

The Government is fully alive to the facts, and points probably to the true cause, namely, that the rewards which have been sanctioned by the Supreme Government are too small (two annas per snake). The work is a hazardous one, and should be paid for accordingly. Coloured models of all the poisonous varieties have been furnished to every tahsil and thana. The high death ratios recorded above show where the destruction of poisonous snakes ought to be most actively carried on.

Deaths from hydrophobia appear to be increasing in the Punjab, as the following numbers show:—

Years.	Deaths from Hydrophobia.
1879	69
1880	107
1881	139
1882	128

A remedy is evidently needed for this evil.

Of deaths by wild beasts 20 were by jackals, 10 by wolves, six by scorpion stings, five from boars, and three from bears.

22. *All other Causes.*—There were 122,989 deaths so registered in 1882, but an attempt has been made by the Sanitary Commissioner to introduce some order into this classification, and the results have been well worth the trouble. He has been able to extricate 29,645 deaths out of the general confusion, and to class them under the head of cough and chest diseases.

The following table gives the numbers for two years:—

Months.	Deaths from Chest Diseases.	
	1881.	1882.
January	3,518	3,008
February	3,435	2,534
March	3,185	2,677
April	2,497	2,007
May	2,142	2,428
June	1,800	1,938
July	1,608	1,680
August	1,890	1,810
September	2,510	2,063
October	2,792	2,308
November	2,699	2,914
December	2,828	4,283

We now know approximately that chest diseases caused a death-rate of above 1½ per 1,000 of the entire population of the Punjab in 1882, although there is reason to suspect that the rate was much higher.

The above table shows that the dry warm months are attended by the lowest mortality, and that the death-rates rise during the wet, damp, cold, and variable seasons. The information, imperfect as it may be, is a real gain to the sanitary history of India.

23. Before concluding the disease history of the year, the following statistics may be here introduced. Four hill sanitaria, Simla, Dharmsala, Dalhousie, and Murree, gave the following death-rates in 1882:—

Total population, 19,503.

Diseases.	Deaths.	Deaths per 1,000.
Cholera	—	—
Smallpox	1	0·05
Fevers	180	9·2
Bowel complaints	60	3·6
Total deaths, all causes	443	23

The birth-rate was 10 per 1,000, and the death-rate 23 per 1,000, in part due, no doubt, to invalids at the stations.

Cantonments.—There are 33 cantonments in the province, having a population of 206,689, among which the following deaths were registered in 1882 :—

Diseases.	Deaths.	Deaths per 1,000.
Cholera	—	—
Smallpox	7	0·03
Fevers	1,651	7·9
Bowel complaints	186	0·6
Total deaths, all causes	2,873	14·

The death-rate, 14 per 1,000, was not high, but it will be observed that nearly 8 out of the 14 per 1,000, above a half, was due to fevers.

Lawrence Military Asylum at Sanawar.—This establishment contained 239 boys and 182 girls in 1882, and out of 421 inmates there were 2 deaths, or 4·7 per 1,000. One of the deaths was due to enteric fever in a boy.

Lawrence Memorial Asylum at Murree.—Out of 90 boys and 68 girls there was no death in 1882.

At Sanawar, the total sickness of the year was represented by 505 admissions, of which 2 were from enteric fever, 4 from simple continued, and 11 from paroxysmal fevers.

At Murree there was no enteric fever. There were 2 cases of simple continued, and 3 of paroxysmal fevers.

At neither establishment was there any epidemic disease.

24. *Sanitary Works (Civil).*—In the 32 districts of the Punjab there are 201 municipal towns, from which returns of income, expenditure, and work done in 1882 were received. Their total population is not stated. At the beginning of the year they had an unexpended balance of 108,899*l.* Their actual income for 1882 was 289,538*l.*, making a disposable total of 398,437*l.* Of this amount there was expended 291,302*l.*, and an unexpended balance of 107,135*l.* was carried forward. It will be observed that the expenditure of 1882 slightly exceeded the actual income of the year.

The outlay for sanitary works was as follows:—

	£
1. Conservancy establishment	41,627
2. Paving	7,405
3. Roads and bridges	25,742
4. Drainage and sewerage	17,763
5. Water-supply	12,279
6. Widening streets	3,523
7. Construction of latrines	1,269
8. Repairs of latrines	772
Total	£110,325

The amount is small, but it is satisfactory to see that so large a proportion of it was devoted to the cardinal improvements in conservancy and water supply. Details of works carried out under these heads of expenditure are given, but they merely reproduce the measures adopted under the expenditure heads in different districts, and convey little additional information, except to show that the work was done.

One satisfactory point in the district reports is that the use of town sewage as manure is rapidly increasing, and that considerable sums are being realized by its sale. It is a matter of great importance that the practice should be extended, because, amongst other advantages, it facilitates the immediate removal of household sewage from the houses and village sites. We are glad to see it stated that, in 60 villages in Karnal, manure yards have been established outside their bounds, and that manure depôts for towns are also being provided.

25. There are a few points in the town reports to which attention might very well be called. There is a proposal for removing the sewage of Simla, which is described as follows:—"The sewage from "the main bazaar, as well as from Chota Simla and Boileaugang, will be carried in iron pipes into "the ravine south of Simla." Plans and estimates have been prepared for the work, and it was "in "contemplation to improve the house drains in the bazaar by insisting on owners of houses and "shops using iron pipes of an improved pattern." So far, there appears little to object to in an elementary proceeding such as this is. But in a letter on the subject from the Commissioner of Umballa division the following objections are raised. He says:—"I entirely agree with Major Nisbet's "plan of carrying the night-soil away by hand in iron buckets or *kiltas*, and depositing it in depôts "from which it is to be carried in iron pipes down the hill, but where Major Nisbet proposed, and I "believe this is the plan now before the committee, to carry the night-soil by the pipes down into "the ravines, notably the waterfall ravine. This plan utterly ruins the most beautiful part of Simla

" a stream so beautiful that if it were in Wales or Cumberland a railway would be made especially " to take tourists to see it. This, however, is the least of the objections. It runs great risk of " making the waterfall valley and the river further down permanently unhealthy; and, lastly, it is a " sad misuse of valuable material."

And he purposes, instead of this method, to carry the night-soil in pipes down to the lower spurs, and there trench it.

The ravine where it is proposed to discharge the filth is south of Simla, and, on turning to page 13 of the report of the Sanitary Commissioner with the Government of India, we find it stated by Mr. Blanford, in his meteorological summary for December 1881, that " at the hill stations of the " North-Western Himalaya there was the same striking and anomalous preponderance of west and " south-west winds as in the previous months."

It is a well known fact in regard to these hill stations that the practice of depositing filth and sewage in the ravines is a cause of epidemics among the inhabitants. This arises from foul and pestilential emanations being carried up the ravines by ascending air currents, which, in the present instance, would apparently be intensified by the west and south-west winds. The plan is nothing more than the one which was long ago adopted in Calcutta and Bombay, where it is still carried out, with this important difference, however, that the sewage is discharged now at points where it can do no harm. It must also be remembered that troops and other occupants of these hill stations go down into the ravines and suffer in health from the foul vapours in them.

In the present case the beautiful valley and waterfall may be converted into an epidemic trap by this proposal. There can be no question whatever that the only safe way of disposing of the sewage of Simla is to trench it at points as nearly as can be obtained to leeward of the station by whatever method it may be conveyed, and if trenching is the method that must be adopted.

26. *Amritsar.*—There are two statements about the drainage of this city which appear to require some explanation. One of them is as follows :—" The project for the intramural drainage is also in " hand. The city sewage will be conducted into the ditch round the city, which has been deepened " 9 feet to admit of a proper flow from all connected sewers, and from it will be conducted in an " egg-shaped sewer to settling tanks to be constructed at about 3,500 feet from the city walls, where " the solid contents will be allowed to settle, and the liquid to flow away into the system of extramural " drainage." The other statement on a subsequent page is as follows :—" The main drain is nearly " complete, and the internal drainage of the town is constantly being improved. The filling in of " the city ditch has seriously been taken in hand by the municipal committee." It is not clear whether the ditch referred to in the two passages is the same. And we must hope that in the first passage it is not intimated that the catch water sewer for the city sewage is to be merely a deepened city ditch, and not a properly built and covered up sewer. Ditches of this kind ought never to be used for outfalls.

27. The only other remark which appears to be called for under this heading is, that a considerable amount of good surface work appears to have been done in the 49 Punjab towns in 1882, and we may conclude these remarks on this section of Mr. Bellew's report, by the mortality statistics as follows, for these towns :—

Population 1881	-	1,310,383
Death-rate all causes in 1882	-	33 per 1,000
Death-rate, previous 5 years' average	-	47 "
Difference	-	14 "

The present rate is still too high, but there is no reason to call in question that the rate has declined, especially as registration is improving, and consequently a larger proportion of deaths is registered each succeeding year.

28. *General Remarks and Personal Proceedings.*—Under this heading, which forms Section X. of the report under review, are given some interesting particulars about the year's inspecting work. The civil surgeons in the course of their tours inspected 80 towns and 178 villages in all the 32 districts of the Punjab. Similar work was done by vaccination officers, but there are numerical data only from 20 districts, in which, however, no fewer than 14,211 villages and towns were inspected and reported on, and in many of them improvements were carried out.

This department of the work is only in its infancy, but nevertheless work of some kind has been done, the people are being taught the importance of local cleanliness, and village authorities are becoming more alive to their duties. A few extracts from the civil surgeons' reports will show how this inspecting work is proceeding.

The Civil Surgeon, Karnal, trained his vaccinators for sanitary work. He found that village lambardars would not listen to the vaccinators unless their suggestions had received the approval of district officers. The tahsildars were then requested to help vaccinators, who thereafter proceeded with their work of inspecting and reporting, and they framed maps to show what were their proposals; these were authorised by the civil surgeon and returned to the tahsildars for execution. But the result was simply opposition. "In many cases the lambardars and zamindars objected, their reasons " being innumerable; then often when these individuals had agreed, the chamars or sweepers of the " villages would object, and submit to me a petition begging of me to remove the site (for depositing " filth and sweepings) to some other spot." The chief cause of objection in such cases was the distance of places of deposit, but this difficulty was overcome by the personal influence of the civil

surgeon. There was a disposition shown to revert to old filthy practices, a matter not to be wondered at after ages of neglect of ordinary sanitary precautions, but there were signs of this disposition having yielded to perseverance and reason, and the reporter says:—"On the whole, however, I think that a great deal can be done by perseverance, and I am quite certain that a great "many of the villages that came under the sanitary work last hot weather are patterns of cleanliness "as compared with those that were not inspected by the vaccinators." So far, then, work has been done, but the difficulty does not lie here, it lies in the keeping up of continuous cleansing, and a proposal is made to effect this object by punishing the officials of neglected villages.

Apparently what is wanted is a common nuisance law, under which "the lambardars should be made responsible for the sanitary condition of their villages," and subject to the usual penalties for default. So far as the experience has gone it shows that some such course is requisite. The objects to be aimed at are initiative and persistence in the work after it has been commenced, and if means are provided for this purpose, the vaccination officers might do the rest by local inspections and advice to the people and village officials, without trying to enforce orders, which in some cases they appear to have done. But even as the case stands there is reason to believe that these periodical inspections are doing a considerable amount of good among village populations.

29. Much more is being done in towns and districts under municipal and district committees, especially in the important matter of cleanliness. The Sanitary Commissioner states that "a great "deal of practical work in the way of improving the sanitary condition, especially with regard to the "monopoly of town sweepings and filth by the municipal committees, has been effected. In the case "of several towns in which the town refuse was regularly stored and systematically disposed of as "manure for fields, and fuel for brick-kilns, there has been not only a marked improvement in the "general cleanliness of the town area, and this without any extra expense, but, so far as statistics "prove, in their healthiness also." . . . . "In the case of towns there can be no question of the "advantages of an improved system of conservancy under the careful supervision of municipal "authorities. The great difficulty is in the way of improving the sanitary condition of villages." Does not this experience prove that what is wanted for the villages is simply a sanitary authority and executive? The people are the same in either case. The towns are only a little more populous, some of them scarcely more populous than the villages.

Of Sirsa district, the Deputy Commissioner says:—"As long, however, as we have no compulsory "powers, such as those levying special conservancy taxes, our efforts must necessarily be confined to "moral suasion." This is apparently true, but as we long ago insisted on, the things to be done ought all to be done by the people themselves, simply because every household can do all that is required for protecting its health by cleanliness, and preserving its water-supply from pollution. Spade labour could be used for levelling, filling up holes, and surface draining. Cattle can be kept within village limits, where they would do no injury to health if properly attended to; roads, lanes, and house compounds can be kept clean. These things could be required from all village populations and village officers, under fines for non-compliance. But if the people prefer to have the work done on a general village plan, there would be no hardship in calling on them to pay for having it done for them. There are several cases mentioned in the district reports in which the required steps had been taken by the people under pressure from the village officers, and it would almost appear as if these officials held the key of the position, and that the work might be done by holding them directly responsible for it.

In reference to this stage of the work it may be stated that brief abstracts are given by the Sanitary Commissioner of reports from all parts of the province, from which it appears that much was being done in many localities to give effect to recommendations made by inspecting officers.

So far the results, if not altogether satisfactory, have been at least hopeful for the future.

It is stated that "in the matter of sanitation the Bagars rank first, the Sikhs next, and the Mussal-"mans last. The principal offenders against sanitary laws are the women, who are too indolent to "remove their house refuse to a proper distance from the village." In such cases a cleansing tax might be of use.

30. *Inspection Reports.*—Under this head is given a summary of reports on towns and villages, prepared by the Sanitary Commissioner, and a similar summary of inspection reports made by Deputy Sanitary Commissioners, and by civil surgeons.

Mr. Bellew's reports refer to inspections made by him during the cold season of 1882, in Amritsar, Dera Ismail Khan, Bannu, and Kohat districts. The summaries give a general account of the topography, towns, vaccination, and sanitary works and measures in each district. The facts are of the usual character, and do not require comment, but a few points may be noticed. In Amritsar town the streets were remarkably clean and wholesome, a result which has been effected by the introduction of tramways for the removal of filth and refuse, and the Sanitary Commissioner advised their adoption for Lahore and Delhi, where they would afford great advantages over the native method of dealing with such matters. The municipality had under consideration a proposal for filling up the Santokhsar tank, and converting it into a garden, a work which Mr. Bellew says is "highly to be commended for the sanitary advantages associated with it." There are other tanks in Amritsar, and many other towns which might be similarly dealt with very advantageously for the interests of the public health. The outfall sewers had been completed. The general sanitary condition of the city was satisfactory, but much remains to be done before Amritsar is safe from fever epidemics. Its five years' death rate had been 72 per 1,000, which in 1882 had fallen to 41 per 1,000, and of this high rate 22·26 per 1,000 was due to fevers.

Dera Ismail Khan.—A great deal has been done by Deputy Commissioner Major Macaulay for the improvement of this town. "Altogether the town bore a very clean, prosperous, and wholesome appearance," but conservancy required to be carried beyond the principal streets into the lanes and

compounds, and drainage was required, as is shown by the great fever death-rate, 28·39 per 1,000, out of a total death-rate of 45 per 1,000. The whole district is feverish. The registration shows a fever-rate of 25·08 per 1,000, out of a total death-rate of 30 per 1,000.

Edwardesabad is comparatively a new town of 4,906 inhabitants, in Bannu. This town has been supplied with water from the Kurrain river and wells. The river water flows through the town, apparently for cleansing purposes, and is afterwards used for irrigation. Well water is raised by a Persian wheel from a depth of 120 feet, and is distributed through a closed reservoir by means of 20 brass taps, six or seven of which are set apart for Hindus. Conservancy and other arrangements of the town appear to be well attended to by the municipal committee "when under immediate supervision," but, continued Mr. Egerton, the municipal secretary, "they want initiative, and are apt "to look on sanitary measures with good-natured *toleration* rather than *energy*, which degenerates "when left to themselves into *apathy;*" and, he adds, "it is men of energy as well as intelligence and integrity who are required to work sanitary reform."

31. *Reports of Deputy Sanitary Commissioners* refer to the result of their inspections of towns and large villages in a number of districts. They disclose many defects in drainage, water-supply, paving, and cleansing, but they also show that work of some kind is being done by municipal committees.

Of the town reports, that on Jullundur is interesting, as giving a fair idea of the causes of past unhealthiness of this town. Its five years' death-rate had been 47 per 1,000, and in 1882 it had fallen to 28 per 1,000, of which 10·68 was due to fevers. This town is subject to serious invasions of epidemics, the full causes of which have not been evident in the reports of past years. In the present summary of Surgeon-Major Bennett's report there is much additional information on this subject, which it may be worth the trouble to extract, as showing the probable condition of used-up Indian towns in low undrained districts. The street drains are described as "for the most part ill laid and badly kept, . . . and more or less obstructed by silt and *débris* thrown into them." But, on the other hand, "the drains of nearly half the area of the town are flushed twice a day from "two municipal wells constructed for the purpose." In many of the larger streets the surface of the roadways was cut up into ruts, and the sideways much out of repair. Comparatively few mohallas are paved, "and on the surface of the ground are numerous depressions in which the sewage coming "from the neighbouring houses is allowed to collect. In many places house-sinks were seen at the "sides of the roadways considerably under the general level, and unprovided with outlet drains." Contrivances such as these are nothing more than pits for passing sewage into the subsoil, where it is sure to be found. Within the mohallas "filth and house sweepings were seen to be collected in heaps, and private latrines were met with from which fluid filth was issuing, and percolating into the soil." Such main drains as exist lead to flooding in heavy rains. "Round about the city walls are hollows "and depressions of surface occupied by large ponds, into which the drainage of the city and the "local floods are received. In 1875 and 1878, during the monsoon rains, a great part of the country "about Jullundur became heavily flooded from excessive rainfall, as well as from the influx of flood "waters from the north, the ground became water-logged, and a fatal form of malarious fever became "epidemic."

It is satisfactory to be informed that active steps have been taken to prevent by embankments some of the flooding, and to lessen its influence by extensive relieving drainage works. It is further proposed to effect the drainage of some of the extramural ponds. Possibly the reclamations effected by such works might contribute largely towards their cost, estimated at 2,000*l.*

It is matter of great interest to watch the results of these works on the health of Jullundur. Its fever death-rate in 1882 had apparently fallen greatly below the rate of previous years.

The following are the conservancy arrangements:—"The street sweepings, together with the "solid excreta, are removed twice a day, and used by contractors as fuel for their brick-kilns. The "zamindars are in the habit of collecting filth and house refuse in the courtyards of their houses, "and, removing it from time to time to fields, use it as a manure." This last practice ought to be put a stop to, and the whole conservancy carried out by the municipal authorities, who should also dispose of the manure.

Water is obtained from 522 wells inside and 370 outside the town, and the state of these town well waters brings us information on the state of the subsoil.

All the town samples examined showed sewage pollution. Even in the case of a new well sunk by the municipality for flushing, the water yielded sewage salts in great abundance. The reporter states that he had examined this well while in the process of construction, and found that "the soil "and subsoil to a depth of 20 feet was chiefly composed of sand and clay, with old bricks inter-"spersed, the remains of a former town, and blackened sewage deposit mixed with the soil, the whole "giving off a heavy offensive odour." From this experience it follows that no well within the town area can be safe for domestic use. But with so great an excess of water at no considerable distance from the town it ought to be matter of no great difficulty to obtain filtered water, and to convey it in pipes.

The municipal well in such a case might be of use in washing out the subsoil of the town.

It may be useful as a matter of experience to state that a well close to a large cemetery north of this town yielded water containing a considerable quantity of ammonia, but no other sewage product.

The sanitary history of Jullundur and its periodical pestilences appears to be tolerably complete. It is the history of all old neglected cities everywhere, and might have been paralleled by London in the middle ages, and in all similar cases the remedies are the same. London, with its vast population, has been cured by drainage of the subsoil and houses, by rapid removal of all sewage to a distance, by closing bad wells and substituting water of better quality, by good paving and surface drainage, and by rigid attention to cleanliness; and similar remedies in the way of prevention and cure are applicable to all such towns as Jullundur. It is necessary to state this much on account of a note in

the Deputy Sanitary Commissioner's Report, in which he says that "the whole soil is utterly contaminated, but the committee is, of course, unable to counteract this work of centuries." This may be true as regards the sanitary methods in use, but if the town were properly drained and cleansed, so as to keep all sewage and foul water out of the subsoil, if good water were provided and the existing wells filled up, the foul subsoil would, in time, be rendered innocuous by the slow process of oxidation if no addition were made to its impurities by infiltration from the surface.

32. As it is just of as much importance to avoid mistakes in sanitary works as it is to execute them where required, the following account of how work may be done to the worst possible advantage may be quoted from the same report. It relates to a small town or large village, Bangha, which has the following provision for draining:—"The sewage and drainage of about half the area of the town are "carried by a large underground sewer from near the middle of the town at the end of the Sandhola "bazaar, to the western skirt, when it ends in a ditch leading to a large pond adjoining the town "on the west; it runs in the main line of drainage from east to west, and is of sufficient capacity to "allow men to enter it, while, along its course, manholes open into it at frequent intervals. In these "holes all kinds of filth, sweeping, and house refuse are thrown, which block up the channel of the "drain, and together with the contents of street gutters opening into it, convert it into an elongated "cesspool, foul smells and noxious effluvia are freely given off, and the drain, instead of serving any "useful purpose, is a positive nuisance to the people living in its neighbourhood, and especially to "those occupying the houses under the basements of which its course lies." It does not even remove heavy rainfall. We suppose this must have been an old work; if so, the best course would be to destroy it, and to level and surface-drain the town by proper gradients to an outfall. If the work is of recent construction it would be well to publish the name of its proposer, with a full detail of the reasons for its execution. No wonder that sanitary engineering is looked at in certain quarters with suspicion when such things are possible.

33. *Hoshiarpur.*—Of this town it is stated that, "the main streets are well paved and metalled, "with sufficiently capacious open drains well protected by cement at the sides. Considerable atten-"tion appears to have been paid to the cleaning of the streets; and the drains in which the sewage "was seen to be flowing freely are flushed and swept daily. The smaller streets and 'mohullas' are "for the most part paved, many of them having well convexed surfaces with drains on either side." In some narrow streets and passages repaving was required. "The drainage of about three-fourths of "the town is carried by two large open sewers, made of solid masonry, into the main outfall sewer "drain." This drain is tapped at several places for irrigation purposes. The whole sewage of this and other outlets might be possibly similarly disposed of.

Water is obtained from 175 wells inside municipal limits, and 34 wells outside.

It is instructive to compare the analysis of samples of each made by the Deputy Sanitary Commissioner, who says that "of 10 samples obtained from the town wells, four showed the presence of chlorides, sulphates, and nitrates in considerable quantity." Seven samples obtained from wells outside were comparatively free from these salts, "and the water in all respects appeared to be pure and wholesome." To show how wells may in time become in reality the deposit drains of town sewage, it may be stated that the worst of them was a well 150 years old.

Hoshiarpur has evidently been much improved of late. It contains 18,263 inhabitants. Its death-rate in 1882 was 26 per 1,000 against the preceding five years' average rate, which was 41 per 1,000. With one single exception its fever death-rate, 7·46 per 1,000, was by much the lowest of 49 municipal towns.

Rawal Pindi district.—We have had more than once to refer to the neglected state of towns and villages in this district, and the present Report shows that the same neglect of cleansing and sanitary precautions was still met with in 1882.

34. The inspections made by civil surgeons in municipal towns revealed a similar condition of matters; it is therefore unnecessary to add to the illustrative cases given above. All reports were sent to the Sanitary Commissioner, together with the recommendations of the inspecting officer, and steps were taken by him to bring these under the notice of municipal committees.

The practical result of the year's inspecting work was to show that considerable sanitary improvements were in progress in certain towns and districts, that in others less had been done, but that in all there is plenty of simple elementary improvement necessary.

35. We cannot conclude these remarks without stating that, as we have not unfrequently felt compelled to notice the extent to which theories about epidemic diseases had apparently interfered with real sanitary work, so in the present instance we are bound to state that where these speculative views have been discarded, medical officers, so far as can be judged of from the abstracts given of their reports, have shown themselves quite competent to grasp local sanitary problems in a very practical manner, and if their advice is followed by the local authorities, future progress in diminishing the liability of the people to outbursts of epidemic diseases may be confidently expected.

In our remarks on the Report for 1880 we called attention to a singularly interesting sanitary dialogue drawn up by Mr. Bellew, and we are glad to find that "the dialogue has not only been "translated into the vernacular, under the orders of the Punjab Government, in the office of the "Director of Public Instruction, but that it has also attracted the attention of the local vernacular "newspapers and others. The editor of the 'Takmil-il-Hikmat,' a paper which is widely circulated "all over the country, has made a translation of it in his journal. The Sanitary Commissioner of "the Southern Deccan, Belgaum, has applied for a copy, and I have received an application from

" one Ayn Singh, Inspector of Police, Lahore central office, to be allowed to translate the same into " Punjabi. Fifty thousand copies of the dialogue have been printed off, and will now be supplied to " all the districts of the province at one anna per copy."

36. The Punjab appears to be on the road towards developing an active, efficient, and practical sanitary administration. In this respect it is setting an admirable example to other provinces. The one thing required at present is to bring Government influence to bear on those officials who ought to do the local sanitary work, especially in the villages, so that the inspections now being carried out on so large a scale may bear fruit.

In our "Suggestions for the Sanitary Improvement of Indian Stations" (1882) we have laid down the principles which are more or less applicable to all such cases as those described in this Report, and we cannot conclude without expressing our thanks to Mr. Bellew for the large amount of useful and interesting information which it contains.

18th January 1884.

No. 6.

Memorandum of the Army Sanitary Commission on the Report of the Sanitary Commissioner for the North-West Provinces and Oudh for 1882.

1. Mr. Planck's Report for the present year commences with a terse and interesting account of the year's meteorology, drawn up by Mr. Hill, the reporter, in compliance with a request from this Commission, that, under the special epidemic conditions prevalent in the North-West Provinces and Oudh, it was necessary that statistics of disease should be accompanied by the statistical elements of climate. Our object was not the one answered by this digest, which, however, we shall refer to further on. Every year's experience of Indian epidemics has shown that a certain relation exists between the elements of climate and the epidemic mortality. It is necessary to ascertain what this relation is, and there is no other way of arriving at it except by placing side by side the statistical facts under each head. In cities and large towns there are at present, or there ought to be, daily meteorological records and daily records of deaths from the chief epidemic diseases, and all that is required is to tabulate the two records side by side on suitable forms, one for cholera, one for small-pox, and one for fever. The more important elements of climate are daily rainfall, daily maxima and minima of temperature, daily ranges and daily moisture, winds, and their direction and force. But for districts, monthly epidemic deaths under the same headings, ranged alongside the average monthly climatic elements referred to, could be made to answer our object, especially if in one or two larger towns, where all the facts are attainable, daily records were published. The subject is one of great importance, especially in irrigated and flooded districts, because it includes among its results the whole question of local drainage. Besides this practical object the time appears to have arrived when every effort should be made to obtain a more satisfactory and a more scientific basis for our knowledge of epidemic laws than can be arrived at by merely general data.

2. The population data used in the Report are those of the census of 1881, and are as follow:—

Population North-West Provinces and Oudh.

Males	22,912,556
Females	21,195,313
Total	44,107,869

3. The registered births for 1882 and the ratios on this population were—

	Numbers.	Births per 1,000 of Population.
Males	875,616	37·34
Females	780,543	36·82
Total	1,656,159	37·54

These figures represent the results of birth registration in its fourth year of existence, and they show either that the ratio of children born is larger in India than in not unprolific England, or that more births were finally recorded by the registering machinery in use than were at first reported. Unless accuracy is ensured at every transfer of a number, there will of course be errors in the final results.

4. The district birth registration is generally high in amount, but it presents great discrepancies. At one extremity of the scale we have Dehra Dun and Kumaon with birth-rates of 22·42 and 23·68 per 1,000, and at the other Shahjehanpur and Lalitpur, whose birth-rates were respectively 47·72 and 53·03 per 1,000. No doubt part of this inaccuracy in final record may be accounted for as follows:—

The Sanitary Commissioner says: "For our record of births we depend entirely upon the report "of the village and town watchmen, and yet it is absolutely impossible that these watchmen should "have cognizance of all the births that occur." But besides this source of error, which might account for the lower rates, he says further, "without doubt they hear of a great many births, and probably record all they hear of, and this more especially in the villages," a proceeding which would account for all the excesses. The Sanitary Commissioner makes a good suggestion to meet these difficulties, which is apparently worthy of some local trial, namely, that every birth should be reported by the head of the family, who might experience a feeling of gratification in doing this duty. "At least," he says, "it would have the effect of introducing the custom of report by the only reliable person, and pave the way to its more perfect realization hereafter." Eventually, if found to answer, it might be extended to reporting of deaths also.

5. The following were the deaths in 1882, and the ratio on the population of 1881:—

	Numbers.	Deaths per 1,000 of Population.
Males	794,740	34·48
Females	690,387	32·57
Total	1,485,127	33·67

The total death-rate in 1882, without taking into account any increase in the year's population, is 2·11 per 1,000 higher than the previous five years' mean; a result which may indicate better registration as well as increase of deaths, but part of the increase appears to have been due to cholera, the death-rate from which exceeded the previous five years' average by 1·18 per 1,000.

The registered death-rates, although generally higher than usual, in Indian districts varied greatly, like the registered births. Here, again, Kumaon and Dehra Dun yielded the lowest death-rates, namely, 20·56 and 21·46 per 1,000. The highest death-rates of the year were yielded by Bareilly, 52·10 per 1,000, and Terai, 59·63 per 1,000, due mainly to fevers, which gave a death-rate of 36·15 per 1,000 for the former and 47·79 for the latter district.

6. Registration of deaths is much further advanced than registration of births, for we have the following statement by the Sanitary Commissioner that "the names of all the 1,485,127 persons who died in 1882 stand recorded in the registers."

Without accepting these results as quite accurate, it is impossible to ignore them or their consequences to practical sanitary work in these provinces, and these are that the average death-rates must be accepted as showing the sanitary condition of districts, and occasional excesses above this standard, the liability of the people to suffer from epidemic outbursts, the two classes of data constituting what Mr. Planck graphically calls the local "death penalty."

7. The death-rates of 1882 divided between town and country circles yielded the following comparative ratios:—

	Population.	Deaths.	Deaths per 1,000.
Towns, 103	2,756,493	113,219	41·32
Districts, 49	41,351,376	1,371,908	33·15
Total	44,107,869	1,485,127	33·67

The town death-rate was 4·35 per 1,000 over the preceding five years' average, but the district country death-rate was 6·95 per 1,000 above the previous five years' average. The town death-rates showed great differences in amount. The lowest rate, 18·25 per 1,000, was returned from Hardoi, with a population of 10,026, against a previous five years' average of 23·44 per 1,000. The highest rate of the year, and we must hope the highest rate of any town in existence, was 73·41 per 1,000 at Sambhal in Moradabad district. This town has a population of 21,373, and its five years' death-rate was 65·59 per 1,000. No less than 35·04 per 1,000 of the enormous rate of 1882 was returned as due to fevers. The cholera rate was only ·33 per 1,000, so that for every death from cholera there were 107 deaths from fever. It would appear on the simple facts of this case, that it should be dealt with at once, for surely no instance of greater need of improvement could be cited, and there are few cases in which the results would be more satisfactory if the necessary works were intelligently planned and skilfully carried out.

8. Our next abstract gives the statistical data for sanitary purposes in each of the 49 districts of these provinces on the census of 1881, and the births and deaths of 1882. We are glad to learn that

the weekly returns of mortality in the larger municipalities are now published in the "Government Gazette."

Districts.	Population 1881.	Area in Square Miles.	Births.		Deaths.		
			Total, 1882.	Ratio per 1,000, 1882.	Total, 1882.	Ratio per 1,000, 1882.	Ratio per 1,000 previous 5 Years.
Kumaon	493,641	6,000·0	11,689	23·68	10,150	20·56	21·25
Garhwal	345,629	5,500·0	13,854	40·08	7,911	22·89	20·70
Tarai	306,993	937·8	7,709	37·24	12,343	59·63	41·29
Bijnor	722,459	1,867·7	29,712	41·13	21,570	30·93	35·49
Moradabad	1,115,173	2,231·8	46,283	41·71	49,588	42·98	38·84
Bareilly	1,030,936	1,614·3	42,950	41·66	53,709	52·10	41·39
Pilibhit	451,601	1,371·6	17,513	38·78	23,241	51·46	29·93
Shahjehanpore	856,946	1,745·7	40,900	47·72	34,534	40·29	43·53
Budaon	906,451	2,004·8	39,748	43·85	34,314	37·85	40·52
Kheri	831,922	2,992·3	30,982	37·24	28,096	33·77	23·57
Sitapur	958,251	2,251·1	42,492	43·39	42,380	44·23	27·29
Hardoi	987,630	2,811·6	45,613	46·18	29,116	29·48	32·45
Dehra Dun	144,070	1,193·0	3,231	22·42	3,092	21·46	19·27
Saharanpur	979,544	2,221·4	42,758	43·65	35,375	36·11	34·67
Muzaffarnagar	758,444	1,656·1	29,841	39·34	23,066	30·41	36·79
Meerut	1,823,137	2,379·2	59,826	45·56	45,084	34·29	41·95
Bulandshahr	924,822	1,914·9	41,465	44·83	27,328	29·54	46·01
Aligarh	1,021,187	1,955·3	37,991	37·20	24,401	23·89	47·04
Etah	756,523	1,738·8	26,654	38·91	22,554	29·81	36·76
Mutra	671,690	1,452·7	21,951	32·68	18,414	27·41	46·31
Farukhabad	907,698	1,718·8	36,748	40·49	28,372	31·26	36·94
Mainpuri	802,216	1,597·2	25,052	31·23	23,185	28·95	36·16
Agra	974,656	1,849·8	38,200	37·12	29,695	30·47	45·55
Etawah	732,371	1,693·6	22,476	31·11	21,165	29·30	31·08
Lucknow	696,824	989·6	28,845	40·67	27,447	39·39	37·53
Bara Banki	1,026,788	1,768·2	42,436	41·08	35,587	34·66	29·34
Unao	899,069	1,746·7	32,139	35·74	26,461	29·43	34·94
Cawnpore	1,121,396	2,370·0	44,955	39·03	49,582	43·97	38·25
Fatehpur	663,745	1,638·7	25,879	37·08	28,178	41·21	33·38
Jaunpur	1,209,663	1,554·1	35,080	29·00	36,895	30·50	19·39
Hamirpur	507,337	2,288·5	29,247	43·85	19,562	38·56	35·53
Banda	698,608	3,061·2	26,098	37·35	26,317	37·67	31·55
Allahabad	1,324,186	2,633·1	38,544	26·44	43,850	29·47	26·65
Rae Bareli	951,995	1,738·3	35,089	33·16	38,324	32·82	29·62
Sultanpur	957,912	1,706·9	33,210	34·67	34,806	35·81	25·13
Pertabgarh	847,047	1,486·5	31,038	36·64	30,460	35·96	25·66
Bahraich	878,048	2,740·8	33,004	37·58	21,878	24·35	26·43
Gonda	1,270,926	2,875·2	46,989	36·53	31,011	24·40	25·71
Fyzabad	1,093,319	2,889·0	37,567	34·35	37,543	34·72	26·31
Gorakhpur	2,517,720	4,598·1	110,429	43·19	85,269	32·58	29·09
Basti	1,630,612	2,752·8	65,553	40·20	48,595	29·80	29·04
Azamgarh	1,604,654	2,147·4	46,365	29·20	52,282	32·58	24·38
Ghazipur	1,014,099	1,473·0	28,538	28·14	33,179	32·72	34·33
Ballia	924,763	1,124·4	24,656	26·65	25,455	27·53	25·08
Benares	992,684	998·0	37,220	34·98	37,094	41·97	24·55
Mirzapur	1,136,796	5,223·3	37,865	33·31	41,033	36·10	25·16
Jalaun	418,142	1,469·4	17,069	40·82	12,845	30·72	31·87
Jhansi	383,227	1,566·8	15,453	46·37	12,859	38·56	33·98
Lalitpur	249,088	1,947·4	13,210	53·03	8,440	33·88	31·25
Total for the Province	44,197,869	106,103·9	1,656,159	37·34	1,485,127	33·67	31·56

This abstract table shows the present condition of registration in every district of these provinces, and it is evident, from the facts, that great progress has been made in this fundamental part of public health work, although the striking differences in the registered ratios appear to shew that local improvements in the machinery are required. But, making any reasonable allowance for inaccuracies, it is impossible not to be struck by varieties in death-rates which the table presents, and there is every reason to accept them as indexes of the district sanitary conditions. The last two columns appear to show that the death-rates of 1882 were above the average in many cases, while the total excess of deaths in 1882 over the rates of the preceding five years was 2·11 per 1,000. The birth-rate was also above the averages for two preceding years, which were 28·69 and 32·55 per 1,000.

9. Following our usual order, we shall next give an analysis of the death causes in 1882, and the lessons which the facts appear to teach.

Diseases.	Total Registered Deaths.	Deaths per 1,000 of Population.
Cholera	89,872	2·03
Small-pox	26,628	0·60
Fevers	1,098,414	24·90
Bowel complaints	93,661	2·12
Injuries	21,133	0·49
All other causes	155,919	3·53
Total	1,485,127	33·67

In 1882 these provinces were visited by a severe epidemic of cholera, and yet a reference to this abstract shows that, of assigned death causes, injuries and small-pox alone yielded lower death-rates. The bowel complaint mortality exceeded the cholera mortality by 4,289 deaths, while the fever mortality was above twelve times that from cholera. We have often insisted on the necessity of facts of this class being taken into account as affording a clue to sanitary work. As will be seen in the present case, war has to be waged not so much with the localizing causes of cholera as with the causes of fever, which, for all practical purposes, include the removable causes of cholera, although the local causes of cholera do not necessarily include all the causes of fever.

10. We shall next give a brief sketch of the epidemic history of 1882, beginning with cholera. The following abstract shows the annual prevalence of cholera in the North-West Provinces from 1865 to 1876, and then in the conjoined North-West Provinces and Oudh for five years, 1877 to 1882:—

Years.	Cholera Deaths per 1,000 of Population.	Years.	Cholera Deaths per 1,000 of Population.
1865	2·53	1874	·20
1866	·32	1875	1·33
1867	1·95	1876	·95
1868	·64	1877	·74
1869	3·06	1878	·52
1870	·44	1879	·84
1871	·11	1880	·67
1872	1·64	1881	·58
1873	·49	1882	2·02

These figures, up to 1869, show epidemic augmentation every second year until 1869, then a triennial augmentation up to 1875, since which year the annual cholera death-rate has been under one per 1,000 until 1882, when it rose to 2·02 per 1,000. The death-rates from this epidemic in town and country circles were as follow:—

Localities.	Population, 1881.	Deaths from Cholera.	
		Number.	Ratio per 1,000 of Population.
103 towns	2,756,493	4,801	1·74
49 districts	41,351,376	84,471	2·04
Total	44,107,869	89,272	2·02

11. Cholera was by no means universally diffused either among towns or districts. The town mortality was all yielded by 56 towns, of which 15 had seven deaths and under, several of them only one death. It is true that all the 49 districts, except two, returned deaths, but these districts contain 1,143 registration circles, of which 668 were attacked, and, following the usual law of diffusion, cholera deaths were returned from 10,338 villages, out of a total of 105,321 in the provinces.

12. When the facts are examined more in detail, they appear to show that the cholera of 1882 owed much of its severity to local epidemic intensity (using this expression to describe a simple fact and not a theory). For example, the city of Agra, with a population of 119,079, had only three cholera deaths, or a ratio of ·02 per 1,000. Mainpuri, with a population of 20,236, yielded one cholera death, or a rate of ·05 per 1,000. Muttra had a single cholera death from among 44,775 inhabitants, or ·02 per 1,000. Aligarh, out of 61,730 people, lost 16 by cholera, or 0·26 per 1,000. This group of towns, and a number of others with low death-rates, all lie south of the Ganges.

We shall take another group. Bareilly has a population of 103,160 people, of whom 235, or 2·28 per 1,000, died of cholera. Aoula, in the same district, with 13,108 inhabitants, lost 175, or 13·44 per 1,000. Etawah, with 34,721 people, yielded 213 cholera deaths, or 6·14 per 1,000. Lucknow, with a population of 239,773, had 663 cholera deaths, or 2·76 per 1,000. Rudauli lost 188 people, or 16·49 per 1,000, out of a population of 11,394, and Jais, out of 11,044 inhabitants, yielded 143 cholera deaths, or a ratio of 12·95 per 1,000. These towns all lie among the rivers to the north of the Ganges.

13. The city of Allahabad, between the Ganges and Jumna at their point of union, deserves separate mention, because it was the seat of the great pilgrimage in January 1882, which was attended by three millions of people. The town was crowded by pilgrims, and cholera broke out among them, not only on the bathing site, but in Allahabad itself; and numerous cholera cases were taken into the city for treatment. The population of Allahabad is 87,664, and there were 106 deaths from cholera in the course of the year, or 1·21 per 1,000. Of the 56 attacked towns, 33 had cholera death-rates exceeding that of this pilgrimage town. At the other extremity of the North-West Provinces are the districts about the site of Hurdwar fair, which was held immediately after the Allahabad mela. There was an imported choleraic case at the fair, but no cholera, and the adjacent circles escaped the disease.

14. Taken according to districts, there were several such in Meerut, in which only two or three cases were registered. The lowest registered rates were in Bijnor and Etah, namely, ·01 per 1,000. The highest district rate was returned from Pilibhit, namely, 12·66 per 1,000. Sitapur had a rate of 9·57 per 1,000, and Allahabad, of 1·02 per 1,000. The cholera epidemic of 1882 was most severe in districts north of the Ganges, and in the countries traversed by great rivers, especially near their points of junction. It is worthy of remark that the great irrigated districts lying between the Ganges and Jumna nearly escaped the disease, or at least comparatively.

15. The following were the monthly registered cholera deaths in 1882 :—

Months.	Deaths from Cholera.	Months.	Deaths from Cholera.
January	1,408	July	12,084
February	1,424	August	16,443
March	2,410	September	13,682
April	10,525	October	13,642
May	5,375	November	2,100
June	8,983	December	226

In tracing the history of an epidemic, especially in its relation to pilgrimages, dates are of the highest importance, but there are no dates available in the present case, except those of monthly prevalence. When the pilgrims departed from Allahabad they were under cholera influence, and many died on the lines of railroad, as well as on the ordinary country roads, but the deaths, so far as could be ascertained at the time, took place solely among pilgrims. The present Report contains no further statistical information on the subject. It is merely stated generally that of a total of 1,403 deaths from cholera recorded throughout the province in that month (January), 1,272 were registered amongst the people living within a radius of 100 miles from that city (Allahabad), and that in February, of 1,424 cholera deaths, 1,110 were registered among the same people. But this fact may have arisen simply because of the relative position of Allahabad in the south-eastern epidemic region of these provinces, where cholera epidemics usually begin in connexion with cholera in Bengal. We learn from the tables that in January there were 335 deaths from cholera in the seven districts of Benares division. But in the same month cholera had shown its presence in most of the districts and in all the divisions of these provinces, except Jhansi, and that in the subsequent months the epidemic followed its usual course of progress, like a rising wave, from the south-east to the north-west, where it attained its maximum mortality after this had declined in the south-east districts.

16. The general epidemic history of 1882 is well summarized by the Sanitary Commissioner in the following passages of his report :—"Noticing particularly the ratios of 1882, it may be observed "that this cholera prevalence occurred amongst the people of the eastern districts, neighbouring " Bengal, and of Oudh, and of Rohilcund, sparing in great measure the people of the Doab, of the " five northern districts Kumaon, Gharwal, Tarai, Bijnor, and Moradabad, and of the three " southern districts, Jalaun, Jhansi, and Lalitpur. Indeed, it may be stated, with a great " approach to correctness, that cholera disease in the epidemic form in 1882 affected only the " population living between the Ganges and the Himalayas, and there, indeed, only in selected " centres of population. . . . . The serious and unexpected mortality from this cause " was that which occurred in the north-western districts, Lucknow, Bara Banki, Sitapur, Kheri, " Shahjehanpur, Budaon, Bareilly, and Pilibhit. These districts form a continuous country north " of the Ganges river, and their mean ratio of mortality from cholera in 1882 is 5·56 per 1,000. " The epidemic in the western districts commenced at the very time the epidemic prevalence ceased " in the eastern districts. This is in accordance with the usual experience, which intimates plainly " that epidemic cholera disease may be expected to prevail early in the year in the eastern districts, " and late in the year in the western districts of the province.

"So invariable has the rule appeared, that one of two things seems certain, either the cause of the " epidemic prevalence travels from east to west, or the local conditions upon which it depends for " vitality are developed at a later period of the year, in the western districts."

We need scarcely point out that these problems are the very ones for which for practical purposes it is most desirable to find a solution, and it was for this purpose, among others, that we were desirous of obtaining meteorological data. Not a general monthly discussion of climates, but statistical data for districts. To show the importance of this requirement, we shall give the monthly prevalence of cholera in Benares division, with a population of 9,367,643 in the south-east of the provinces, and in Rohilcund of 4,602,846 in the north-west.

Months.	Cholera Deaths.	
	Benares.	Rohilcund.
January	338	2
February	175	4
March	693	5
April	7,241	8
May	3,293	7
June	4,315	48
July	5,366	259
August	9,479	3,065
September	993	6,965
October	654	7,325
November	104	403
December	37	24

It will be seen from these figures that the epidemic wave reached Rohilcund in June; that in July it was falling in Benares division and rising in Rohilcund; that in August, September, and October the epidemic transfer was completed between the districts, and that in the concluding weeks of the year subsidence at both ends of the line took place. Now it is most desirable that we should have more light than we possess on the causes of this very remarkable phenomenon. It is very probable that this may come from meteorological facts, which ought to show the succession of climatic elements in each district to place alongside the epidemic succession in each. With such facts before him, the Sanitary Commissioner would be better able to arrive at a conclusion on the important question how far these elements of climate act independently, or through the agency of local causes and conditions.

This information is too imperfectly given in the general discussion on climate in the present Report to be of use, but it can easily be made sufficient from existing records.

17. On the question of localizing causes of cholera, there is a fact mentioned of grave importance, although it ought not to be an unexpected one. The Sanitary Commissioner gives a list of 616 localities, together with the deaths from cholera registered in each, and referring to this list he says, "By comparison of this list with the list of previous years, it may be learnt that some centres "of population are becoming noted as places of cholera epidemic prevalence. But they are not as "yet numerous. As years pass, I have little doubt they will increase in number, to the ultimate "determination of the places in each district where sanitary improvement is most desirable." Ought not this point to have been put otherwise? Does not the occurrence of a single death from cholera indicate a local danger, to be immediately dealt with? and ought not centres of population becoming more liable to cholera to be taken as showing the results of previous sanitary neglect? The distinction is an important one, and contains a principle everywhere applicable, namely, that where cholera has been allowed for once to locate itself, it is liable to return at next epidemic. In England, the first case in a previous cholera locality has been known to occur not only in the same house and in the same room, but in the same bed. In the words of the Sanitary Commissioner applied to the amount of cholera in particular places, "This proof of special prevalence in certain localities, which I may "say has always characterized cholera outbreak in this province, points unmistakeably to some "peculiar condition of locality as favouring this unexpected mortality. The generally accepted "belief is, that a neglected sanitary management is answerable for that condition. And without "doubt, wherever cholera disease appears in epidemic force, a great responsibility rests upon the "local authorities in regard to the necessity for improvement in the centres selected for especial "preference by this terrible disease."

This is true, but the responsibility begins before the epidemic comes, and the victims it selects in all localities are simply the penalties levied on previous neglects of duty. This is the sum of the whole matter.

18. *Small-pox.*—Deaths from this disease in the rural districts of these provinces were 21,296 in number, equal to a death-rate of ·51 per 1,000 of the rural population. In the towns there were 5,332 deaths, equal to a ratio of 1·33 per 1,000. In town and country combined, the small-pox deaths numbered 26,628, giving a death-rate ·60 per 1,000 for the whole population, against a previous five years' death-rate of 1·39 per 1,000.

The past death-rates for the 49 districts in the North-West Provinces and Oudh have been as follows:—

Years.	Small-pox Deaths per 1,000 of Population.	Years.	Small-pox Deaths per 1,000 of Population.
1870	·8	1877	·8
1871	1·2	1878	3·9
1872	1·1	1879	1·7
1873	2·8	1880	·1
1874	2·5	1881	·8
1875	0·7	1882	·6
1876	0·9		

The year 1878 was the year of scarcity of food, and yielded a true epidemic death-rate from small-pox, as was the case in other districts of India.

The distribution of small-pox mortality among the 49 districts presents some curious anomalies during the 13 years in this table. Some of the districts have yielded small-pox deaths in every year. In others a year or two now and then have been exempt. In others, again, the earlier years or the later years alone have suffered. In no one year have all the 49 districts registered deaths from this disease. Generally, two, or perhaps three, districts have escaped, but during the last three years there has been a marked reduction in the area covered by small-pox. Thus, in 1880 no deaths were registered in 31 districts, in 1881 none were registered in 23 districts, and during the last year of the series 22 districts alone yielded the small-pox mortality of 1882. This fact only implies that in many districts the mortality was too small to yield ratios, for, as a matter of record, every district yielded small-pox deaths in 1882 except Dehra Dun. Out of 1,143 circles of registration, 637 were affected, but the entire year's mortality was yielded by 8,403 villages out of a total of 105,421.

19. The monthly mortality from small-pox was as follows :—

Months.	Deaths from Small-pox.	Months.	Deaths from Small-pox.
January	514	July	3,238
February	617	August	1,422
March	1,217	September	562
April	2,218	October	491
May	4,665	November	1,294
June	4,963	December	5,271

This table bears marks of two epidemic outbreaks, one in the hot season and the other at the end of the year, but this latter augmentation took place chiefly in Lucknow district. The most severely affected district was Lalitpur, which yielded a small-pox death-rate of 5·94 per 1,000. In this area small-pox deaths were registered during every month of the year, and 22 registration circles out of 24 yielded deaths.

The same law held in this and other severely affected districts, as we have shown often to be the law of cholera. Lalitpur contains 670 population groups, of which the large proportion of 660 suffered from what was a distinct local epidemic, showing the necessity for increased vigilance in sanitary work, including vaccination.

20. *Vaccination.*—The following abstract, showing the numbers vaccinated for a series of years, is of importance when considered in relation to a statement of the Sanitary Commissioner about the figures :—

Years.	Successful Primary Vaccinations.	Years.	Successful Primary Vaccinations.
1870	199,674	1877	625,064
1871	286,997	1878	622,458
1872	337,593	1879	524,735
1873	369,916	1880	640,224
1874	375,244	1881	684,026
1875	430,906	1882	598,906
1876	532,861		

Of late years, as will be seen, there has been a great increase of vaccination operations pronounced to be "successful," but a large falling off in 1882; and the following is the explanation given :—"As a "matter of fact, the apparent decrease of primary operations in 1882 has not been due to any serious "decrease of efficient vaccination in that year, but to the elimination from the record of cases of "pretended primary vaccination which had vitiated the total results of previous years, raising them "to a figure of progress to which they have no just claim." The error appears to have been mainly incurred in Oudh, Rohilcund, and Kumaon, where the vaccinations admitted fell short by 93,195 of the preceding year's number.

Where the successful vaccinations are the results calculated on percentages examined, errors of this kind are very likely to happen; but we may place the vaccinations, as a whole, alongside the yearly mortality from small-pox given in a preceding table, and by doing this we obtain what appears to be satisfactory evidence of lowered small-pox mortality.

If, however, the actual births be compared with the successful vaccinations of the last four years, we shall at once see that great extension of vaccination work in these provinces is necessary, but, unfortunately, the deaths among children are not available to complete the data, which are as follow :—

Years.	Births.	Successful Vaccinations.
1879	1,225,832	524,735
1880	1,390,870	640,224
1881	1,779,473	684,026
1882	1,656,159	598,906
Total	6,052,334	2,447,891

It is probable that the actually protective vaccinations do not much exceed one-third of the births, but the vaccinations include all ages, and not merely infants.

The successful vaccinations according to age were—

Under one year	258,200
Over one and under six years	288,784
Total of all ages	598,906

which last is the corrected number given in the preceding table. The general result is, that in 1882 about 15½ per cent. of the children born may possibly have been vaccinated, but allowance must be made for those born in 1881. Statistically, however, the vaccinations in infants amounted to 15½ per cent. of the births, a very small ratio when dependence is placed on this protective power of vaccination, and showing how large an extension the work requires.

21. The vaccination staff under the Sanitary Commissioner for 1882 was as follows:—

Superintendents of circles	5
Deputy superintendents of circles	7
Native superintendents	50
First class vaccinators	273
Second „ „	345
Servants, &c.	63
Total staff	743

Successful vaccinations and re-vaccinations amounted together to 693,792. The total cost was Rs. 117,686 14 7, and the average cost of each successful operation was As. 3·1. The facts as a whole show clearly the present condition of the work, and where improvement is required.

22. *Fevers.*—We shall begin our notice of this class of diseases by referring, in the words of the Sanitary Commissioner, to the unsatisfactory nature of disease definitions, to which we have directed attention year after year.

Mr. Planck says, "As a general rule, almost all deaths from diseases of the general system other "than fever, almost all the deaths from diseases of the internal organs, are returned as deaths from "fever, because a feverish condition is a symptom of such diseases. And this extraordinary and most "vexatious circumstance is due in great measure to the careless and uneducated character of reporting "agents, the country watchmen."

The complaint is the same all over India, and there is no use concealing the fact that Indian fever registration is quite unreliable. We have formerly suggested that possibly some improvement might be introduced in this important statistical division if an instruction were issued to the reporters to cease recording deaths as from fever where heat of skin was the only diagnostic mark relied on, and to substitute for it paroxysmal character. But if this mark were adopted, it would have to be adopted generally, or errors of another kind would be introduced.

23. As already stated, the deaths assigned to "fevers" in the registration returns of these Provinces amounted to no fewer than 1,098,414 during the year 1882. The fever death-rate of the year was for males 25·58 per 1,000, and for females 24·16 per 1,000. The average rate for both sexes was 24·90 per 1,000, which was 1·05 per 1,000 above the preceding five years' average.

The fever death-rate in country districts was 24·86 per 1,000, and in the towns 25·57 per 1,000.

A sufficient indication of the extent of registration error is afforded by the fact that nearly 74 per cent. of the total mortality in 1882 is assigned to this one cause. Every district returned fever deaths in 1882, and 1,116 circles of registration out of 1,143 made similar returns.

All towns making returns of deaths and nearly all villages, 105,421 in number, reported fever deaths.

The monthly numbers were as follow:—

Months.	Deaths from Fever.	Months.	Deaths from Fever.
January	93,302	July	81,170
February	73,796	August	103,139
March	75,183	September	144,663
April	76,183	October	114,788
May	87,832	November	102,533
June	79,423	December	96,403

This table shows a preponderance of fever mortality during the fever months, but not to such an extent as might have been anticipated had the diagnosis been more accurate.

24. Fever mortality was lowest in Jhansi division, in which division Lalitpur district registered a fever death-rate of 7·27 per 1,000 against a previous five years' average of 11·15 per 1,000. In other districs most of the death-rates were between 20 and 30 per 1,000, and the highest rate of the year was in the Tarai, namely, 47·79 per 1,000, against a previous five years' rate of 34·03 per 1,000. Town fever death-rates varied considerably; the lowest of the year, 7·49 per 1,000, was in Lalitpur town, and the highest, 70·94 per 1,000, took place in Ajudhia. In a number of towns the death-rates were 4 and 5 per cent.; but, generally, the town death-rates were lower than those of districts, due, probably, to less inaccurate registration.

The great fever mortality in the Tarai is apparently due to local and climatic peculiarities, but the Sanitary Commissioner states, that it "occurs chiefly amongst persons who are unacclimatized settlers "in the district." Indeed, he says, "I think only the Tarus or aboriginal inhabitants of this district "escape from attack of fever disease, which prevails at one time or other of the year against every "foreigner."

25. The relation of canal irrigation works to increase of fever death-rates is again referred to in the present report, although it cannot be said that any fresh light has been obtained on the subject. Only the fact is, year by year, more firmly established that such a relation exists. A remarkable instance is cited in Fatehpur district, in which, under extending canal irrigation works, the fever death-rates during ten successive years ending 1882 have been in the following annual ratios per 1,000 :—12·2, 9·7, 10·5, 13·0, 10·6, 15·5, 37·6, 32·0, 28·2, 31·56. The ratio of 37·6 per 1,000 marks the irrigation period. "Meerut, Saharanpur, Cawnpore, and Mazaffarnagar, all districts of excessive "canal irrigation, witness to the continued action in that year (1882) of this cause of excessive "deaths." In these districts the fever death-rates were 30·96, 29·09, 29·0, and 28·32 per 1,000 respectively.

In the irrigated districts, taken as a whole, the fever-death-rates were all high in 1882, and, to show the past fever history of these districts, we may quote the following table from the present year's report :—

Districts under Canal Irrigation.	Fever Deaths per 1,000 of Population.				
	1878.	1879.	1880.	1881.	1882.
Saharanpur	21·7	42·4	31·9	27·1	29·0
Muzaffarnagar	26·7	58·7	42·5	29·2	28·3
Meerut	25·4	81·9	42·2	33·5	30·9
Bulandshahr	21·6	118·7	28·9	29·1	25·6
Aligarh	21·1	118·5	23·8	23·4	20·6
Etah	23·7	57·8	23·3	25·4	27·0
Farukhabad	29·8	42·7	29·3	27·2	27·6
Mainpuri	27·4	63·4	29·7	26·4	27·5
Etawah	24·7	45·8	31·0	26·6	24·5
Cawnpore	20·6	46·3	29·0	26·2	29·0
Muttra	59·0	63·9	22·2	22·4	22·5
Agra	37·3	52·3	21·6	22·4	24·3
Mean	29·1	67·9	28·0	26·5	26·8

We have already seen that the fever mortality for the Provinces was 24·90 per 1,000 in 1882, with which may be compared the rate for these districts, 26·3 per 1,000 in the same year, but it must be borne in mind that the total rate of 1882 includes the higher rates of these irrigated districts. We thus arrive at the conclusion that, if the errors in diagnosis are similar all over the Provinces, the fever death-rate is everywhere very high, and that this high rate is exceeded in the irrigated districts by 1·4 per 1,000 at least.

26. The meteorological data given in the present report do not enable us to arrive either at the localization or distribution of rain, so that it is impossible to separate the influence of rainfall from that of irrigation.

What the probable influence of this latter element may be can be judged of by the following account of irrigation practice in these districts :—"There cannot be a doubt," says the Sanitary Commissioner, "that extensive irrigation operations do tend to increase fever prevalence and "mortality, and that such result must be accepted as one of its unavoidable attendants. The medical "history of Northern Italy witnesses to the truth of this, and there, I believe, the actual irrigation of "land neighbouring the habited site is forbidden. No such rule is enforced in this province, and "nothing is more common than the persistent irrigation of land touching the walls of the habitations. "As a result, many habitations of canal irrigated districts may be found with dampness permeating "the walls up to the tiles or thatch which form the roof. Of all the causes favouring the attack of "fever disease perhaps none is so potent as residence in a damp house."

This general statement of the case may be accepted as correct, but we cannot admit that the excessive fever rates of these irrigated districts are amongst the "unavoidable attendants" of irrigation. In most of the warmer districts of Southern Europe, where there is deep soil under wet cultivation, there is fever, as there is fever in districts of an opposite character. The only difference as regards India lies in the condition of the people, and in their far higher fever death-rates even where there are no irrigation works, which death-rates are subject to sudden and great augmentation everywhere, but especially in irrigated districts by abnormal rainfall. When there is superadded scarcity of food, for the prevention of which irrigation works have been carried out, these fever death-rates may assume the character of a pestilence. The point for consideration, therefore, is, whether the occasional loss of life from scarcity would be less without irrigation than it is known to be at present under irrigation and abnormal rainfall in a series of fairly plentiful years. The account of dwellings given in the preceding extract furnishes the reply, for no population living under such conditions can escape great loss of life year after year from fever. And the sanitary problem is simply how to obtain the unquestionable benefits of irrigation to the food supply of the people without a great annual destruction of life from wet subsoil and damp habitations. The answer must be that, beyond the possibility of doubt, excess of water added to the soil of these provinces, especially in cases where there is an impervious subsoil which retains it, and more especially in saline soils where putrid decomposition is likely to take place in organic matters in these wet saline soils, is the most potent known agent of fever causation. The remedy is, of course, generally that drainage of subsoil should accompany irrigation, and that some method should be adopted to limit or apportion the amount of water applied to the land. There are, no doubt, also local drainage problems requiring

separate study; but, taking everything into consideration, we feel quite warranted in stating that high fever death-rates are not "unavoidable attendants" on proper irrigation, drainage, and agriculture, and this is true even if it be admitted that it would be practically impossible to extirpate fever and its causes in India or elsewhere.

27. These remedies, however, are quite apart from sanitary measures applicable at present to every village and town; the chief of these are cleansing and keeping clean, protecting water sources, filling up water holes, and local drainage cuts to free the subsoil under houses from excess of water. Raising the floors of the houses above the ground level should also be done. All this is well known; but if fever mortality is to be diminished in these Provinces, it can only be accomplished by translating the knowledge we possess of local fever causes into practical action for their removal.

28. *Bowel Complaints.*—The following was the monthly mortality from diseases classed under this head in 1882 :—

Months.	Bowel Complaint Deaths.	Months.	Bowel Complaint Deaths.
January	6,124	July	8,699
February	5,092	August	19,111
March	5,085	September	11,695
April	5,772	October	10,636
May	6,673	November	8,267
June	6,446	December	7,062

Of these deaths, 12,510, equal to a death-rate of 4·54 per 1,000, took place in the towns, and 81,151 in country districts, giving for the latter a death-rate of 1·96 per 1,000. The total bowel complaint death-rate for the Provinces was 2·12 per 1,000, against a previous five years' average of 2·20 per 1,000. The number of population groups furnishing the deaths is not given in the returns, but these diseases prevailed in all the registration districts, and in 1,068 registration circles out of 1,143 in the Provinces.

The Sanitary Commissioner thinks that deaths classed under this head are chiefly from dysentery, and he points to the fact of the greater mortality from them in the autumn months appearing to indicate a malarious origin.

If this be the case the remedial measures against them would fall under the same category as those against fever. There must be local causes of some kind for the much greater fatality from bowel diseases in certain districts than in others. Why, for example, should Hamirpur yield a rate of 7·93 per 1,000 per annum raised in 1882 to 10·38 per 1,000, or Garwhál have a bowel complaint death of 9·64 per 1,000 in 1882, and a previous five years' rate of 6·99 per 1,000, while there are 17 districts in which the death-rate is under 1 per 1,000? most of them less than half this amount. It is by investigating problems of this kind that light is most probably to be obtained on the causation of disease.

29. *Injuries and Accidents.*—Under these heads were registered 21,133 deaths in 1882 = ·49 per 1,000 of the population. The chief causes were—

Suicides, Males	615
" Females	1,645
Wounds and accidents	12,358
Snake-bite and wild beasts	6,515
Total	21,133

The remark made on the last of these heads by the Sanitary Commissioner is "the registration of "the last five years appears to witness to a progressive increase of deaths from snake-bite and attack "of wild beasts." What appears to be required in this matter is more outlay in the way of reward, and greater activity in this branch of the public health service.

30. *All other causes.*—No fewer than 155,919 deaths, or a death-rate of 3·53 per 1,000 of the entire population, were returned under this head. The town registration showed 7·15 per 1,000 in circles where registration ought to be so far advanced as to reduce materially the number of deaths, of the causes of which we have at present no knowledge.

31. We shall conclude our remarks on the disease history of 1882 by introducing the following statistical data for 24 cantonments in the North-West Provinces and Oudh :—

Population, 1881	193,049
Deaths, all causes, 1882	4,680
Or 24·24 per 1,000.	
Of these,—	
Deaths from cholera	53
Small-pox	11
Fevers	3,162
Bowel complaints	329
Injuries	74
All other causes	1,051

It cannot be said that these cantonment populations are healthy while nearly three-fourths of the entire mortality were due to fevers in 1882.

32. *Sanitary Works (Civil).*—The following summary of the year's sanitary work is given by the Sanitary Commissioner:—"Works of sanitary improvement continued to be effected throughout the "year in all parts of the province. I select those most worthy of record, excluding a great number "of minor improvements of this character which are locally important, without doubt, and attended "with considerable benefit to the populations concerned, but do not require separate record. Indeed, "it may be truthfully said that sanitary improvement characterizes the management of every important "centre of population, so general is the desire to improve their appearance and condition as places "of residence."

We accept this statement as satisfactory so far as it goes, provided the actual sanitary condition of the people, as shown by the statistics, is not overlooked, for we find that while the total death-rate for five years averaged 26·20 per 1,000 per annum for the rural population, this had risen in 1882 to 33·15 per 1,000. For the towns, however, there is statistical evidence of improvement in the fact that the death-rate in 1882, which was 41·32 per 1,000, very high, no doubt, showed a considerable reduction below the preceding five years' average rate, which was 45·67 per 1,000.

The statement of sanitary works, referred to by the Sanitary Commissioner, includes 83 cities or districts, and are of the usual simple proceedings, such as surface drainage, well cleansing, water-supply, filling up hollows, provision of latrines, paving, tree-planting, improved conservancy, and the like. The most important works have been the completion of the Almora water scheme, by which water is brought to the town from its source in an iron pipe to a covered reservoir, whence it has been distributed to the people. In Saharanpur town "a large number of filthy lanes in the most "densely crowded parts of the town were paved and drained. Most of the cesspools were done away "with." Provision was being made for flushing out the surface drains by water taken from the Jumna Canal. This essential addition to all town surface drainage works was completed at Roorkee, and successfully worked with beneficial results.

At Cawnpore a pipe drain was being laid for carrying canal water to flush out the main drainage channel.

The survey of Gorakpur town had been completed, and the main drainage lines determined.

The surface drainage of Lucknow was being extended and other improvements carried out, but this large city has still to be provided with proper drinking water.

The chief work at Benares appears to have been filling up holes with town sweepings and rubbish. The Sanitary Commissioner very properly observes that "the resulting surface will not be a safe residence for men," and he advises the only safe treatment of such cases by tree-planting, and also we would add by cultivation or the formation of garden ground.

33. Whatever importance may be attached to these very partial improvements, it cannot be questioned that the following statistical evidence of their real sanitary state amounts to a proof that local disease causes in these towns have only as yet been very partially dealt with.

Towns.	Population, 1881.	All Causes Death-rates per 1,000.		Fever Deaths per 1,000, 1882.
		1882.	Previous Five Years.	
Saharanpur	59,194	37·47	38·19	20·46
Gorakpur	55,936	30·84	36·02	21·93
Cawnpore	120,161	53·63	47·17	36·70
Lucknow	239,773	54·02	45·68	27·10
Benares	193,925	52·23	31·85	34·20

34. *General remarks.*—The first point of importance requiring notice under this head is the account given of the Allahabad mela of 1883, in contrast with the previous year's mela of 1882. On this latter occasion some three millions of pilgrims were crowded on the triangular area between the Ganges and Jumna without due sanitary preparation, and cholera broke out among them. At the next mela in 1883, there were some 300,000 persons present. "Comprehensive and efficient measures were enforced," says the Sanitary Commissioner, "in aid of the general and sanitary welfare of the "assembled people under the immediate orders and direction of the magistrates. . . . A "remarkable surface cleanliness was maintained everywhere in the fair site and in its neighbourhood. ". . . . All the conditions of lessened crowd, drier site, improved cleanliness, greater order, "conspired to give the fair of 1882–83 a character of comparative pleasantness from a sanitary point "of view. . . . . Certainly no disease like cholera occurred from the beginning to the end of "the mela."

At this fair we have another example of application of sanitary principles and freedom from epidemic disease. Another point ought also to be noticed as bearing on the question of healthy and unhealthy camping sites, and this is as follows:—During the great fair of 1882 with its three millions of visitors the whole site was polluted when the crowd dispersed.

In the course of the year the rise of the rivers "newly fashioned" the site; it was higher raised, and firmer than during the great mela of January 1882, and, no doubt, the subsoil was also cleansed by the year's rains.

35. The following important statement on the influence of railway communication on sanitary works is made by Mr. Planck:—"As a rule the sanitary aspect of the centres of population inspected "was satisfactory. Wherever means are provided for the realization of improvement, and local "authority exists to direct it, a very commendable advancement is apparent. So considerable, indeed, "as quite to alter for the better the appearance of places formerly characterized to my knowledge by "appearance of neglect and careless management. The advancement in aspect of respectability and "improved sanitation is most obvious in towns which have been provided with railway communication. "Almost without exception this result of better management seems to follow upon the opening out "of communication, so that I have come to look upon the railways as the greatest power in aid of "my especial work. Wherever the railways go, there inspections multiply; things unknown before, "or only suspected, come to the surface. And wherever knowledge of marked insanitary conditions "is acquirrd by frequent observation, there improvement follows. Streets are paved, excavations are "filled up, surface impurities removed, over-crowded quarters opened out." These are not the least among the important results already achieved in India by railway communication, but there is nevertheless a small and fortunately diminishing section of etiologists who would set at nought these advantages, and have us believe that railways are among the chief vehicles of epidemic cholera.

36. The Report under review contains little sanitary detail. The Commissioner appears to have been chiefly occupied in the investigation of false vaccination returns, and in overlooking the registration. Towns and villages were also visited, but the details are not given. Generally, however, he states that the recently appointed local authorities have not as yet fairly entered on their work. "The district boards do not yet perhaps quite apprehend their new position, or the opportunity it "confers of doing good." But he at the same time says that "certainly nothing of improvement "already established in the towns lately inspected has been allowed to fall back." This is so far well; but it refers only to the towns, for he says that "little, if anything, has yet been done, I think, "to better the condition of the smaller market townships, or chief villages of a group." These are the places where local produce is brought for sale. As a general rule their market-places are much neglected, the surface undrained, often broken into holes. The wells also require attention.

37. The only sanitary notes are those taken from a report of Dr. Pringle, of the first vaccination circle, who states as follows:—That the wells in cantonments generally in his circle are not properly cared for; that so plentiful is the fall of leaves into them that a thick layer of leaf mould collects at the bottom of the well, the water which rises through it having "hurtful properties likely to produce fever, dysentery, or diarrhœa."

In regard to the water-supply of Chakrata, Dr. Pringle states that the supply tanks "collect contaminated water likely to cause typhoid fever in the consumers" (troops sent there for their health), and he urges the use of iron pipes without delay.

At Landour, he states his opinion that soda-water has been made from the impure water of a tank into which sewage entered.

At Mussoori a permanent water-supply has been provided out of municipal revenues, at the cost of Rs. 30,000, "a permanent sanitary improvement without equal in any municipality in India." And he contrasts with this work and its cost the expenditure of Rs. 30,000 a year at Chakrata for the "carriage of water on mules" there.

The supply of Dehra Dun is liable to pollution by native habits along its channel, and Dr. Pringle proposes to filter it. But the only real remedy is to convey the water in closed pipes along all the course where such pollution is possible. He further advocates a very proper substitution of pumps for raising water at railway stations, instead of permitting the use of cords and lotas in all states of impurity for drawing water. He advocates the use of Bull's dredger for cleansing wells to improve the water-supply and reduce the prevalence of fever among the people. The prohibition of slaughtering animals within town sites is also advocated.

There is a leper asylum at Dehra Dun, containing 58 inmates. It is doing much good in its sphere, but may soon have to be closed unless assisted by Government. This is a matter which appears worth considering. The only other point in Dr. Pringle's report concerns the unhealthy central prison at Meerut, which it is proposed to remove to a new site, "as it is impossible to improve the existing site, because, being two low, it is water-logged beyond any possibility of efficient drainage."

This case, like many others in India, shows the need of correct topographical knowledge of soils, subsoils, means of drainage, &c. before a site is selected for building on, and the proposed remedy with its great cost might probably have been rendered unnecessary if the principle we long ago laid down had been observed, namely, that if a site does not admit of being efficiently drained it should not be adopted.

38. We have endeavoured in the preceding paragraphs to give an abstract of the disease history of the North-West Provinces and Oudh, and also of such an account as is available of the sanitary state of population and the works and measures in progress for its improvement. It cannot be said that the practical sanitary administration in these Provinces has overtaken the work of the sanitary inspector and reporter. No man has worked harder than Mr. Planck to expose the sanitary defects under which this great population lives, and, after many years of effort, he has been obliged in this the latest of them to give us such an account of the public health as to show that real fundamental progress in dealing with the causes which have decimated the people has scarcely been entered on. It is true that much surface work has been done among the comparatively small population of the towns. But what of the 105,421 villages with their 41,351,375 inhabitants? Can it be said in the face of these death statistics that anything has been done for them to save life? We can only deal with the facts as they come before us, and surely if any step could be justified by such an exposure as

they have made it is an earnest recommendation that the administrative authorities should make it a chief object to consider them, and to proceed without delay to deal effectually with the worst cases at least. We have long ago pointed out in our "Suggestions" the simple measures of cleansing and keeping clean, protection of wells and water sources, drainage, equalizing the surface, removing manure beyond the boundaries of villages, and cattle from houses and house compounds, which would do much to improve the health of village populations all over India; we have also called attention to the fact that surface and outside improvements in towns may leave untouched the real disease causes within houses and compounds.

The new municipal authorities require to be instructed in their duties, and measures adopted to ensure as far as practicable that these duties are efficiently performed. But the chief sanitary duties lie among the village populations, and some method to be determined by Government requires to be applied, whereby the village authorities may be required to do their duties in this matter. The end of the whole discussion is that the sanitary inspector and reporter has done his work, and the administrative officer has still to enter on his proper function.

In the matter of irrigation and drainage proceedings must necessarily be taken by the Government, but some method should be adopted to limit the use of irrigation water to the simple requirements of agriculture.

And above all, no time should be lost in turning the information already at hand to practical use.

29th April 1884.

No. 7.

MEMORANDUM of the ARMY SANITARY COMMISSION on the REPORT of the SANITARY COMMISSIONER of the CENTRAL PROVINCES for 1882.

1. According to the census enumeration of 1881, the population of the Central Provinces was composed of—

Males	5,801,794
Females	5,703,355
Total	11,505,149

The previous census of 1872 gave a total population of both sexes of 9,251,229, showing an increase in the decade of 2,253,920, or 25 per cent.

But, as the Officiating Secretary to the Government points out, these numbers considerably exceed the "total population under registration," which was 8,802,040 in 1882 as against 7,409,865 at the time of the preceding census of 1872. The increase of registered population has been nearly 16 per cent. in 10 years, and as the ratios were calculated on the population of 1872, the birth-rate under the increased population has suddenly fallen from 48·94 to 41·73 per 1,000, and the death-rate from 32·58 to 29·98 per 1,000.

2. In 1882 the registered births were as follows:—

Sex.	Number.	Ratio per 1,000.
Males	190,466	21·64
Females	176,862	20·09
Total	367,328	41·73

3. The deaths registered during the same year were:—

Sex.	Number.	Ratio per 1,000.
Males	140,521	31·69
Females	123,347	28·24
Total	263,868	29·98

4. The next abstract shows the distribution of births and deaths over the districts :—

Districts.	Population 1881 (under Registration).	Area in Square Miles.	Birth rates, 1882.	Death-rates per 1,000 of Population.	
				1882.	Previous 5 Years.
Saugor	564,950	4,005	48·81	37·27	38·66
Damoh	312,957	2,799	47·28	41·28	37·41
Mawara	205,807	1,176	44·16	27·59	31·90
Jubbulpore	481,299	2,742	43·06	38·58	37·34
Narsinghpur	365,173	1,915	44·23	43·34	34·80
Hoshangabad	488,787	4,437	25·17	29·81	27·33
Nimar	154,677	2,202	45·55	33·55	37·95
Burhanpur	76,446	1,138	33·93	23·34	34·59
Mundla	361,760	4,719	38·34	25·96	37·68
Betul	304,905	3,905	43·27	34·78	31·13
Chindwara	308,388	2,981	45·65	29·30	30·21
Seoni	334,733	3,247	39·33	36·81	29·58
Balaghat	340,554	3,146	39·69	30·06	32·33
Bamdhara	609,279	5,922	41·94	28·34	33·59
Nagpur	697,356	3,786	43·91	28·01	30·24
Wardha	367,221	2,404	39·06	24·64	34·13
Chanda	534,245	10,785	40·89	24·62	30·22
Raipur	1,141,882	5,467	39·92	23·77	35·43
Bilaspur	746,180	3,641	41·12	28·93	35·09
Sambalpur	371,491	1,830	38·66	24·82	25·32
Total for the Province	8,802,040	71,245	41·73	29·98	33·21

These figures refer to the total registering population. Divided between rural and town circles the death ratios stand as follows :—

Districts and Towns.	Population, 1881.	Death-rates per 1,000.	
		1882.	Previous 5 Years.
20 districts	8,054,308	30·47	32·44
72 towns	747,732	27·90	44·14
Total	8,802,040	29·98	33·21

In the 10 years interval 1872 to 1881 it does not appear that any annual estimate of the population was used in calculating the ratios, and hence it would be scarcely worth the trouble to compare the death-rates of 1882 with those of preceding years, were it not that no other data are available. The comparison in the tables already given, namely, an aggregate death-rate of 29·98 per 1,000 for 1882, against the previous five years average of 33·21 per 1,000, is all that need be stated, except that the difference between the two rates must not be taken as a result of sanitary work done.

6. On the general question of registration accuracy there is a remark made by the Sanitary Commissioner that may be quoted, as pointing out a danger which has presented itself in India. He says, "In ordinary years the great difficulty in the way of obtaining accurate returns is that "the reporting officers are often unnecessarily dictated to. When in any circle the number of births "or the number of deaths is a little above or a little below the average, it is too often the practice "to write and demand an explanation, indicating the supposed mistake. When this is done month "after month and year after year, the police authorities are tempted to try to make their returns "agree with the supposed wishes of the Sanitary Commissioner." This is, unfortunately, a Native propensity; but a properly drafted circular, explaining what is actually wanted, and positively forbidding all tampering with the facts on pain of punishment, might possibly lead to greater accuracy in reporting. Explanations of this nature are frequently necessary under all statistical organizations, and in the present case the matter has not been overlooked by the Government, for in cases of doubt a chief constable is deputed to make a house-to-house inquiry when considered necessary. Possibly the method suggested by the Sanitary Commissioner of the North-West Provinces, of receiving the report of births, and, we have suggested, of deaths also, from the head of the family, might meet the difficulty, at least, in time.

7. We shall next give a brief account of the disease history of 1882. The following deaths were recorded under the usual heads, and ratios are calculated on the population of 1881 :—

Diseases.	Registered Deaths.	Deaths per 1,000.
Cholera	11,952	1·36
Small-pox	3,945	0·45
Fevers	152,407	17·31
Bowel complaints	24,639	2·80
Injuries	4,236	0·48
All other causes	66,709	7·58
Total	263,868	29·98

8. Taking each of these death causes in order, we shall begin with—

Cholera, the annual mortality from which for the last 16 years has been as follows:—

Years.	Deaths from Cholera.	Years.	Deaths from Cholera.
1867	253	1875	14,646
1868	7,592	1876	20,124
1869	57,079	1877	3,418
1870	107	1878	40,985
1871	19	1879	27,575
1872	1,592	1880	330
1873	344	1881	9,140
1874	14	1882	11,932

The great mortality of 1878–79 was connected with the famine, and, allowing for these as exceptional years, the statistics show recurring periods of great epidemic prevalence, followed by marked diminution of cholera for a year or two.

9. The report contains a table showing the number of cholera deaths in relation to the year's rainfall, which it is not necessary to give in detail, because any influence exerted by rainfall on cholera is local and temporary, and not general and annual. The lowest rainfall during the 16 years was 29·81 inches in 1868, in which year there were 7,592 deaths from cholera. The highest rainfall was in 1867, with 58·94 inches and 253 cholera deaths. The greatest death-rates of the entire period were those of the famine year 1878, which yielded 40,985 cholera deaths, with a rainfall of 49·31 inches, and the 57,079 deaths of 1869, during which the annual rainfall was nearly the same, viz., 49·38 inches.

10. Cholera was pretty generally diffused throughout the Provinces in 1882, for deaths from it were registered in all the 20 districts, with two exceptions, Burhanpur and Betul, and in 101 registration circles out of 168. But the deaths, as usually happens, took place in a few population groups. In the present case all the deaths were returned from 1,605 groups out of 27,529. And out of 72 towns 31 only returned deaths, 656 in number, or, on an average, a little over 20 deaths per attacked town.

The death-rate for the whole town population was 0·88 per 1,000, and for the rural districts 1·40 per 1,000. The lowest district death-rates of the year were those of Hoshangabad, 0·04 per 1,000, and Sambalpur 0·18 per 1,000; the highest rate, 5·77 per 1,000, was registered in Seoni. A town in Seoni district, Lakhnadon, yielded the greatest death-rate from cholera perhaps on record, namely, 40·74 per 1,000. It has only a small population of 1,350, out of which 55 died of cholera.

11. The following was the monthly incidence of the epidemic of 1882:—

Months.	Cholera Deaths.	Months.	Cholera Deaths.
January	451	July	2,513
February	542	August	3,064
March	186	September	923
April	594	October	265
May	1,236	November	12
June	2,140	December	1

This abstract shows that a wave of cholera passed over the Central Provinces in 1882. In past years attempts have been made to connect the Central Provinces epidemic with that of the endemic area of Bengal by means of pilgrims returning from Cuttack and Juggernauth, and entering the eastern districts of the Province. This idea was not supported by the experience of 1881, and the facts of this epidemic of 1882 show that, wherever the cholera came from, it did not enter the Provinces from the east. The preceding table shows that there were 451 cholera deaths in January, but none of these took place at the eastern extremity of the Provinces. In like manner there were 542 deaths in February, only two of which took place in the East; but still, there was not a single death in the district nearest the endemic area, Sambalpur. It was not until March that Sambalpur yielded six cholera deaths, while the provinces yielded 186 deaths in the same month. Where, then, did this epidemic come from? A map attached to the present report gives the position of cholera as regards the more severely-affected districts, and it appears to show that there were two eruptions of cholera into the Provinces, both from the north. The most severe one entered the northern boundary of the Central Provinces from Bundlecund and from the south-eastern districts of the North-West Provinces, where the disease began to assume an epidemic form in January 1882. The map shows the epidemic in its more severe form as extending right across the Provinces from north to south, with a breadth of about 70 miles, until it entered the Berars. The minor outbreak is shown to have arrived from Chota Nagpur, and to have extended, in a south-eastern direction, to the centre of the Provinces. We have thus two facts presented by this epidemic:—1st, a pretty general diffusion of cholera in a milder form over the area of the Provinces; and 2nd, a distinct invasion from the north in severity along two lines of march.

12. We shall next see what relation these epidemic inroads bore to the cholera epidemic in Northern India in 1882.

Throughout the entire year cholera prevailed all over Bengal as a great epidemic, and 182,352 people died of it, exclusive of deaths in Calcutta. Cholera also existed as an epidemic in the south-eastern districts of the North-West Provinces for the first half of 1882; and in January and February of that year the Sanitary Commissioner had reported 1,172 and 973 deaths from cholera, 2,145 deaths in all, as having occurred in eight districts around Allahabad, lying to the north of the Central Provinces, and at a nearest point distance of about 60 miles. It was in the month of January that the great Allahabad Mela of 1882, described in our Memorandum on the North-West Provinces Report for 1881, was held, at which three millions of people were present; and we shall next examine what was the relation between this fair and cholera, in the region where it took place, as part of the history of the Central Provinces epidemic of 1882.

13. The first case of cholera at the fair took place in a child on the night of 17th January, and the epidemic distinctly showed itself on the 18th and subsequent days. On the 20th January the people began to disperse. But while cholera appeared at the fair it also broke out out in districts outside its influence. Cholera appeared in Sultanpur district on 4th January. On the 10th it was in Banda; on the 15th in Allahabad district, all before it appeared at the fair. On the 20th Partabgarh was attacked, and on the 22nd Fatehpur. Judged by the dates of attack, the fair cholera was part of the general epidemic. But the pilgrims carried cholera away with them from the fair, and died at places along the roads and railroads, without, however, affecting the localities. At a subsequent date the epidemic prevailed severely in Benares district, and crossed the Ganges into Rohilcund, where it occasioned great loss of life before its force was spent.

Pilgrims returning from Allahabad into the Central Provinces were also attacked on the road. It is stated that 95 of them died at Jubbulpore alone. To some extent the experience of pilgrim trains in the North-West Provinces was reproduced in the Central Provinces, but it is important to note as part of the epidemic history that cholera had already shown its presence in these Provinces before it appeared at the Allahabad Mela. The earliest reported case given by the Sanitary Commissioner took place in Kahani circle in Seoni on the 17th January, and it lasted till August. Its time of greatest severity was May and June. It attacked 19 villages out of 185, and occasioned 148 deaths.

This circle lies towards the centre of the Provinces, and 60 miles from the nearest point of the railway. But cholera appeared also at Jabbera, a rural circle in Damoh, 86 miles to the north-west of Kahani, on the 21st of January, on the day after the pilgrims at Allahabad began to disperse. During the month of January there were the following deaths in the Central Provinces within 10 days after the commencing dispersion of pilgrims:—

District.	Total Villages in Districts.	Villages attacked in the Year.	Deaths from Cholera in January.
Saugor - - -	1,333	52	58
Damoh - - -	1,121	293	329
Marwara - -	686	36	18
Jubbulpore - -	1,606	113	35
Narsinghpur - -	983	128	3
Hoshangabad - -	1,344	2	1
Seoni - - -	2,452	252	7

This abstract shows the amount of cholera in the Central Provinces for the week after the fair had completely broken up, and also the villages attacked during the year. The history is an epidemic one, although there is a concurrence of opinion among medical officers that part of the deaths took place among returning pilgrims. The real epidemic, however, did not follow these January deaths. It set in during April, and continued until November. In a preceding table we have given the monthly deaths. The facts, as a whole, appear to point to the following conclusions:—1st, that cholera moved early in the year from Bengal into the North-West Provinces; 2nd, that at the same time the Allahabad Mela was held where cholera appeared among the pilgrims, who also carried cholera with them on their departure; 3rd, that this cholera did not spread beyond the pilgrims; 4th, that of the moving Bengal cholera part passed across the Ganges into Rohilcund, and part moved to the south into the Central Provinces in two columns, one by way of Marwara, and the other from Chota Nagpur to Bilaspur and Raipur. The first column moved into Berar, the second stopped in the centre of the Provinces.

14. We have already seen that out of 27,329 villages, all the cholera deaths of the year were furnished by 1,605. This is one of the facts of which no explanation has yet been given. A year or two ago we expressed a wish that, in marked instances of comparative exemption from cholera, some attempt might be made to solve the difficulty, especially in the towns were good sanitary work had been done. The epidemic of 1882 was a severe one, and yet only 31 towns out of 72 suffered. The total populations of 747,732 yielded 656 deaths, or 0·88 per 1,000, while the more sparse country population of 8,054,308 had 11,276 cholera deaths, or 1·40 per 1,000. Of the towns, 43 per cent.

were attacked, and these yielded 21 deaths per town. The attacked villages were under 5·8 per cent. of the total villages, and the deaths in the attacked villages averaged a little over 17 in each. The facts in either case appear to show a high but limited local intensity. So far as the villages are concerned, there is reason to believe that their sanitary conditions did not essentially vary from those of previous years, and hence the year's experience confirms that of all other epidemics, namely, that some other agency is required to light up an epidemic besides local sanitary defects. This fact is well known, but it is necessary from time to time to refer to it, because of a tendency in some Indian reports to treat sanitary condition as distinctly causative of cholera, *i.e.* without the co-operation of any other agent. One of the civil surgeons in the present Report considers it necessary, in the face of so many observed facts, where sanitary defects have existed in the absence of cholera, to enter a protest against "the argument employed by the supporters of what may be called the 'dirt theory,' that cholera and "small-pox are *caused* by filth, impure sub-soil, impure air, bad drinking water, &c." It cannot be said, so far as existing evidence is concerned, that either cholera or small-pox are *caused*, in the etiological sense, by these local defects, any more than the blowing up of a powder magazine can be said to be *caused* by the presence of the gunpowder. In either case a spark is required to let loose the imprisoned force. Fire may be kept out of a powder magazine, but there are no known means of keeping out the epidemic spark, and hence the only safety lies in getting rid of the magazine altogether. The parallelism may be drawn still closer; for any number of electric discharges may pass through a magazine with perfect safety if there be no powder there, and any ordinary epidemic force may pass over groups of poulation with little or no danger if there be no "filth, impure subsoil, impure air, bad drinking water, &c." But just as no one would argue against the use of lightning conductors for a powder magazine, because the powder had not hitherto been exploded during a thunder-storm, so no argument can be sustained against the most rigid application of sanitary measures in an epidemic country on the ground that some foul villages had escaped cholera or small-pox, while others had unquestionably suffered. Our present knowledge is limited simply to facts, and we do know that the only protection against epidemics everywhere lies in the observance of wholesome conditions of life.

15. Of course, we should all be glad if we could obtain any scientific help in dealing with epidemics. But such help is not likely to come from any of the theoretic quarters dealt with by the Sanitary Commissioner in this Report. We should have welcomed any new facts brought to light during the epidemic of 1882, but, instead of any such help, we are presented with five folio pages of theories about cholera, which are mainly set up to be knocked down. This work is not of the least practical value, and we quite concur in the criticism on it of the Chief Commissioner, who points out "that the "great practical object of that portion of the sanitary report which treats of disease must be to "point out insanitary conditions, to connect disease history with them, and to indicate their remedy."

The opinion of the Sanitary Officer appointed to deal with these conditions is simply as follows: "I have never seen cholera, fever, or small-pox caused by dirt." If this means, not direct causation, but that this officer has never observed any relation between dirt and these diseases, then the question may fairly be asked, What was he appointed for? Had he the necessary qualifications for the work? The expression is probably an unguarded one, for he quotes from the civil surgeon of Wardah, that, in his opinion, "impure air, impure subsoil, and impure water are merely conditions associated "with and favourable to the development of epidemics; they do not in themselves originate "disease." It does not matter whether they do or not. What we complain of is that these conditions are allowed to exist at all, and to be turned in this way into what may very well be excuse for doing nothing. This has occurred before in India.

16. There is not much information in the Report on the main subject of these remarks, namely, the relation of sanitary defects to cholera, but the following may be cited. The Civil Surgeon, Seoni, says, "I noticed repeatedly that in nearly all the villages in which cholera had been "unusually prevalent, it is the custom of the villages to stall their cattle close to and amidst their "dwelling-houses. The stench, principally from decomposing urine, in these villages was very "pronounced." The inference which in this case is made the basis of a theory is denied by the Sanitary Commissioner, because cholera occurs where no cattle are kept.

There appears to have been a considerable amount of inspecting work done of which no account whatever is given in this Report. What is said is usually confined to a single line or two; for example, "Water good, villages not clean, no cholera." "Fairly clean, water good, no cholera." "Fairly clean, no cholera." There are pages of this kind of work, which could just as well have been done in England. Properly speaking, there is no sanitary history of the Central Provinces cholera of 1882. There is plenty of writing, but it is all about generalia; and, moreover, the Sanitary Commissioner appears to have a theory about cholera which does not concern itself with locality. His view, if, indeed, it be the only one he has put forward, is that cholera is due to eating unwholesome rice.

The whole subject is a painful one, and all that can be said is that this year's Report has no practical value whatever, so far as throwing any light on cholera history, or on the far more important matter of showing by what means liability to cholera among village populations can be diminished. What can the Government do when the sanitary administration is in such state that they have to complain that Civil Surgeons evidently report just as if the code (the Village Sanitary Code of 1879) were not in existence? This complaint merely implies that, in the proper sense of the term, there was no sanitary work done by the accredited inspecting officers in 1882.

17. *Small-pox.*—Deaths from small-pox were reported in all the 29 districts of the Central Provinces, with one exception, Chandla, and from 122 out of 168 registration circles. But the attacks

were essentially endemic, as only 1,628 population groups out of 27,529 registered deaths from this disease. Taken by months, the deaths were as follow:—

Months.	Small-pox Deaths.	Months.	Small-pox Deaths.
January	148	July	519
February	224	August	211
March	389	September	142
April	516	October	74
May	573	November	115
June	764	December	241

The hot weather months were, as usually happens, those of highest mortality. The rural circles, with a population of 8,054,308, yielded 3,700 small-pox deaths = 0·46 per 1,000. The towns, with a population of 747,732, had 245 deaths = 0·33 per 1,000. The town deaths were returned from 27 towns out of 72. A number of the attacked towns had no more than one or two deaths. The most severely affected town was Sehora, which lost 57 of its people out of 5,736, or 9·94 per 1,000. The total small-pox mortality of the year was 2,007 males and 1,938 females, in all 3,945 deaths, or 0·45 per 1,000, against a previous five years' ratio of 1·38 per 1,000. Of the deaths, 1,498 took place in children under one year of age.

The next abstract gives the annual death-rates from small-pox in the Central Provinces for a period of 14 years.

Years.	Death-rates per 1,000.	Years.	Death-rates per 1,000.
1869	3·40	1876	0·51
1870	0·20	1877	0·37
1871	0·20	1878	2·18
1872	0·57	1879	3·44
1873	1·37	1880	0·69
1874	2·38	1881	0·24
1875	3·73	1882	0·45

This table shows that, while small-pox is always more or less prevalent, it takes on the epidemic character in groups of years.

18. The relation of vaccination to small-pox mortality is shown as follows:—

Vaccination for Five Years, 1878–82.		Small-pox Deaths, Five Years, 1878–82.	
Total Number.	Ratio per 1,000.	Total Number.	Ratio per 1,000.
1,627,577	173·49	52,588	5·97

The vaccination report for 1883 is not included in the Report under review. But attention may be directed to the fact that there were 367,328 children born in the year, most of whom ought to have become subjects of vaccination during the year.

19. *Fevers.*—We have the usual caution given by the Sanitary Commissioner under this head, that Indian "fevers" include many other diseases attended by heat of skin besides fevers, and he cites the results of an inquiry made by the Civil Surgeon, Wardha, into 46 so-called fever cases, which showed that,—

13 were cases of ague.
7 of infantile inanition.
5 of worms.
10 dysentery and diarrhœa.
4 chronic bronchitis.
2 measles.
1 rheumatic fever.
1 peritonitis.
1 dropsy.
1 calculus.

To this list of diagnostic errors, the Sanitary Commissioner adds the remark that "In India, by "fever is generally understood malarial fever or ague, and there can be no doubt that this is the most "common of Indian diseases, and the one which carries off the greatest number of people." We may here suggest whether the paroxysmal test, if applied to the reporting of fatal fever cases instead of

the heat test, might not result in better classification. If ague is the most common of Indian death causes, it ought to be easily distinguishable by its paroxysmal character. There are however, other fevers mentioned as occurring among the Native population, such as "thermic fever," "typhus fever," "typhoid and relapsing fever." "Thermic fever" attacks suddenly, with well marked head symptoms, and is frequent and fatal in hot weather. "Typhus" is of gradual onset, with head symptoms, and a rash like flea-bites, followed by petechiæ. "Relapsing fever" is of sudden onset, with hepatic and splenic symptoms, and tendency to hemorrhage.

"Typhoid fever," the Sanitary Commissioner says, "has been persistently misunderstood," and then follows a statement which we must notice, although with deep regret, as to the cause of this most formidable and fatal of Indian fevers. He says he believes "that it is a very infectious disease, occurring once in a lifetime, identical with distemper in the dog, and almost invariably caused in a human being by infection from a dog ill of distemper;" which infection he represents as being conveyed from distempered dogs in barracks to young soldiers there, and he supports this view by quite untenable statements, the practical result of which, if true, would be to show that, so far as this fever is concerned, neither soldiers' ages, nor local sanitary defects, nor climatic causes could have any influence on the prevalence or fatality of the disease, either in India or, indeed, anywhere else.

Much more than this might be abstracted about it from the Sanitary Commissioner's report, but what has been said will be sufficient to show that, if this view is really put forward seriously, it must be ranked among those disease theories which have hitherto obstructed sanitary work everywhere. We have no mission to interfere with private opinions on medical subjects, but we have a perfect right, for practical purposes, to ask for specific cases where typhoid fever has been traced to distempered dogs, and where the destruction of barrack dogs has put an end to enteric fever among young soldiers. Without this proof this dog theory, and, indeed, all theories without experience to support them, have no more *raison d'être* than any village theory attributing cholera and fever and small-pox to the anger of local gods or demons.

20. But, to return to the fever history of 1882, we find the following facts regarding its monthly incidence during this year:—

Months.	Deaths from Fever.	Months.	Deaths from Fever.
January	10,805	July	12,311
February	9,876	August	14,969
March	10,580	September	16,445
April	10,813	October	16,475
May	12,127	November	14,882
June	10,695	December	12,429

These monthly deaths show the influence of drying up of the ground and of low temperature on the amount of fever.

Fevers in 1882 prevailed all over the Central Provinces. Every registration circle returned fever deaths. Fever deaths were reported from 21,204 villages out of 27,529. The country registration circles reported 144,230 fever deaths, or 17·91 per 1,000 of the rural population. All the 72 towns returned deaths, 8,177 in number, or 10·94 per 1,000. The fever death-rate for the whole province was 17·31 per 1,000 against a previous five years' ratio of 20·68 per 1,000.

The fever-rate varied considerably in different districts. The lowest rate of the year was returned from Nagpur, namely, 5·24 per 1,000, Wardha returned 9·17 per 1,000, and Sambalpur 8·20 per 1,000 against a previous five years' average of 8·04 per 1,000. We shall refer afterwards to the last of these cases. The highest rate of the year was 29·60 in Narsinghpur district. Fever death-rates varied to a much greater extent in town than in country circles. In several towns in Nagpur district the fever deaths were under 3 per 1,000. In two towns the rates were under 1 per 1,000. In Nagpur town itself, with its population of 98,299, the fever rate was 3·26 per 1,000. Kamptee in the same district returned 23 fever deaths out of a population of 50,987, or 1·24 per 1,000. Most of the higher rates were returned from less populous towns. Seoni, out of a population of 6,928, yielded 225 fever deaths, or 32·15 per 1,000. The highest fever-rate of the year, 35·04 per 1,000, was returned from the small town of Mahrajpur, but it has only 1,541 inhabitants.

21. The local fever-rates vary to a much greater extent than do the annual rates, as is shown by the following ratios for the last nine years:—

Years.	Fever Deaths per 1,000.	Years.	Fever Deaths per 1,000.
1874	15·90	1879	18·84
1875	16·26	1880	18·46
1876	20·22	1881	19·42
1877	17·70	1882	17·31
1878	29·50		

The year 1878 was the famine and scarcity year, which accounts for its higher rate.
As regards the varying local rates, the present report contains no account of their causes.

22. *Bowel complaints.*—In 1882 there were returned 24,639 deaths under this head, equal to a death-rate of 2·80 per 1,000. The preceding five years' rate was 2·75 per 1,000, so that the mortality from this cause is tolerably constant. All the circles of registration returned deaths in 1882, but out of 27,529 villages all the deaths were reported from 8,336.

The monthly mortality was as follows:—

Months.	Bowel Complaint Deaths.	Months.	Bowel Complaint Deaths.
January	1,616	July	2,342
February	1,714	August	3,313
March	1,698	September	3,080
April	1,828	October	2,313
May	1,997	November	1,736
June	1,697	December	1,405

The hot and rainy months are apparently those when bowel diseases are most fatal.

23. The extent to which bowel complaint mortality prevails differs in different districts. In several districts the rate is under one or two per 1,000. The highest rate was 12·38 per 1,000 in Sambalpur district against a previous five years' average of 10·63 per 1,000. This high rate is persistent, and led us in a former memorandum to suggest some inquiry into its cause, with reference also to another peculiarity about its persistently low fever-rate of about 8 per 1,000. We further suggested a comparison between the rates from both causes in Sambalpur and Bilaspur, in which latter districts the rates appeared to be reversed. The problem will be understood from the following abstract, premising that both districts are in the Mahanadi division:—

Districts.	Ratios per 1,000 Fevers.		Ratio per 1,000 Bowel Complaints.	
	1882.	Five Years' Average.	1882.	Five Years' Average.
Sambalpur	8·20	8·04	12·38	10·63
Bilaspur	24·16	26·96	0·40	0·58

The following appears to have been the result of the inquiry:—

(1.) Registration is conducted in the same way in each district.

(2.) The people in Sambalpur district depend for their water-supply on more surface tanks supplied from unprotected surface areas, and the tanks so supplied are used for all purposes, "ablution, drinking, watering of cattle, and washing of clothes." The tank supply falls low, and becomes impure, in the dry weather. These bowel diseases are, moreover, related to great prevalence of worms among the people, a fact which points to impure water containing ova of worms as a probable cause of the whole class of diseases.

It is admitted, however, that further inquiry is necessary.

(3.) As regards the fever. Sambalpur occupies a comparatively unfertile tract with light soil and underlying silicious highly indurated rocks, while Bilaspur is "a damp country, the very place where one would expect malarious fevers."

There are many wells besides tanks in Bilaspur, but in Sambalpur water is chiefly derived from tanks.

These facts appear to point to the causes of difference in disease prevalence in the two districts.

24. *Injuries and all other diseases.*—Under the first head are returned 4,236 deaths, of which 648 were suicides, and 1,287 deaths from snake-bite and wild beasts. Under the head of "all other diseases" are included 66,709 deaths, of which a number were reported as having been due to measles, pleurisy, &c.

25. *Sanitary Works (Civil).*—Abstracts of Civil Surgeons' reports show steady progress in town improvements, so far as any account of such improvements is given. But for 19 towns only is there any account of the municipal income and expenditure. Details are not given, but it is stated that such and such percentages of income were spent on conservancy. The lowest amount under this head is 3·81 per cent. for Jubbulpore. The highest is 69·09 per cent. in Balaghat. A few notes for each town will show the nature and progress of works in hand.

In *Nagpur*, water distribution to private houses from the Ambaghari reservoir was being extended. Conservancy arrangements were being improved, and the surface drains deepened and cleansed. Drainage of the civil station was being improved. This town has been undergoing improvement for a number of years, and has an excellent water-supply laid on by gravitation. Its population in 1881 was 98,299, and its death-rate in 1882 was 30·76 per 1,000, of which 0·89 per 1,000 was due to cholera, and 3·26 to fevers. It has only surface drainage as yet; but conservancy appears to be well attended to.

Wardha.—The Hinghanghat waterworks were nearly ready for opening.

Balaghat.—"A very fine tank is being built at head-quarters." A statement is made about the head-quarter town which may be introduced. Balaghat district had a death-rate from cholera of 2·18 per 1,000. There was no cholera at the station where the Deputy Commissioner "made "arrangements to prevent the lower classes from polluting the drinking-water supply."

Jubbulpore.—The water scheme for this town "has been pushed on vigorously." This town of 60,181 inhabitants has been under active improvement, and in 1882 its total death-rate was 24·94 per 1,000, of which 0·40 was due to cholera, and 11·93 to fevers. The corresponding district rates were 2·80 from cholera, and 17·94 from fevers.

At *Saugor* the water-supply was being improved. Similar improvements had been carried out at Damoh, and surface drains had been formed.

At *Seoni* considerable improvements in water-supply had been effected, and filtered water was in use. An unwholesome irregular tank had been lined with stone, and greatly improved. Drainage and conservancy have also been attended to. This town had an old system of covered surface drains, which were being abolished, and open saucer-sectioned drains substituted, an arrangement much better adapted for purposes of health. It is always necessary to provide water for washing out surface drains in towns. Many open pits and hollows have been filled up. This town lost 5·51 per 1,000 from cholera in 1882, while the district had a cholera death-rate of 5·77 per 1,000. The chief death cause in Seoni, both town and district, is fever, from which the town had a death-rate of 17·38, and the district of 22·65 per 1,000. These figures may shew the direction in which work should be extended. The total death-rate in 1882 was very high, namely, 37·26 per 1,000.

It is unnecessary to pursue these details further, except to state that the main direction which public health works appear to have taken has been the very important one of improving the water-supply. From a table in the Report it appears that in the course of the year 54 wells were repaired, and 226 new wells constructed. These figures, of course, represent a single year's work, one of many preceding years, but the total improvements are very small when compared with the number of villages. None of the year's reports contain any account of the internal sanitary economy of villages or village houses, or of efforts made by Civil Surgeons or by the Sanitary Commissioner to forward village improvements under this head of the Report.

26. We have already alluded to the sanitary statements under the head of cholera. No doubt inspecting work was done; but everything depends on its object, and on the manner of doing it, and the final result is that, without any indication of a single village compound or house having been examined with ordinary sanitary care, we are told that "defects there are, it is quite true, such as bad "water-supply, in many instances cow dung in greater or less quantities always present, but the foul "smells and human excreta in quantities in every direction so often described were very generally "conspicuous by their absence." Where were they, if not outside the houses? And the final result is that "any attempt to introduce compulsory conservancy or sanitary rules in the rural districts, "even if practicable, would be attended with great expense, would inevitably fail, and would in "every sense be an unmixed evil." Of course there are rules and rules, and more ways of administering rules than one, but a general statement such as this can lead to only one conclusion, and this is, that the present sanitary organization can be of little use in these Provinces.

A somewhat similar remark is applicable to the manner in which the vaccination service has been used for instructing the people. It was never contemplated that all vaccinators, merely because they were such, should be constituted sanitary officers. Men of the class of superintendents were considered the most likely to be useful in such work. But it appears as if no training or care had been exercised in the matter, and the vaccinators have hence been disliked by the people.

27. We conclude these remarks with an expression of regret at having been obliged, in the sanitary interests of these Provinces, to have made them. We can only deal with the Civil Surgeon's reports as they have been presented to us, in abstract, in the hope that as a whole, if we had had them before us, we might have been able to have formed a more favourable estimate of the year's work.

As this Report has come before us we can arrive at no other conclusion than that, as already stated, its sanitary contents are without value.

The Officiating Secretary to the Chief Commissioner, as we have said, has expressed regret that the Sanitary Commissioner has in no part of his Report referred to the Village Sanitary Code of 1879, which is the ground of village sanitary work, and "Civil Surgeons evidently report just as if the code "were not in existence. In not a single instance does Mr. Jones find a Civil Surgeon reporting that "such and such a rule has been neglected." And we adopt the views of the Chief Commissioner that this code, with such improvements as experience may dictate, "should be the foundation of all village inspection," and consequently of all village sanitary work. For it never should be forgotten that Indian epidemics have their home in the present foul and neglected state of the villages of India, and that the entire cost of the sanitary service has been incurred by Government for no other reason than to aid in rendering all population groups, as far as practicable, secure against epidemic invasions.*

22nd July 1884.

No. 8.

MEMORANDUM of the ARMY SANITARY COMMISSION on the REPORT of the SANITARY COMMISSIONER of the HYDERABAD ASSIGNED DISTRICTS for 1882.

1. All the statistical data in this Report have been calculated on the census population of 1881, which consisted of—

Males	1,380,492
Females	1,292,181
Total	2,672,673

The previous census of 1867 gave a population of 2,227,654, so that in 13 years there had been an increase of 445,019, or in the ratio of 19·98 per cent. for the whole period, or about 1·5 per cent. per annum. This rate of increase is not abnormal, and ought to represent the excess of births over deaths in a stationary population in health. The difficulty, however, is to ascertain what this excess really is, on account of the great diversity in the annual births and deaths registered in different years. The years of highest registration numbers were 1881 and 1882, and, taken on these two years, the actual increase of population would be about 400,000 in the period. But the population is liable to additions from immigrants, of whom 435,933 entered Berar in the 13 years. It is possible, also, that numbers of people may have left the districts and settled elsewhere. If this were so, the statistics for the assigned districts would be reliable for practical purposes, and the ascertained addition would be the normal one. There appear to be no means of coming nearer the actual causes of increase but the census numbers of 1881, and the latest registration returns may be safely used for purposes of comparison.

2. The population totals already given include Melgat, but the number actually furnishing returns of births and deaths in 1882 was 2,630,018, and from among this number there were registered in 1882, of—

Births	110,454
Deaths	77,214

The births were 42 per 1,000, and the deaths 29·4 per 1,000, of the population. The births exceeded the deaths by 33,240, or 12·6 per 1,000, which, it will be seen, is a little under the average 13 years' increase, which was 1·5 per cent. per annum.

3. The next abstract shows the distribution of births and deaths in the districts:—

Districts.	Ratio per 1,000 of Population.					
	Rural Circles.		Towns.		Total.	
	Births.	Deaths.	Births.	Deaths.	Births.	Deaths.
Amraoti	43·9	31·3	35·3	30·0	42·7	31·3
Ellichpur	42·2	30·3	38·4	26·2	41·4	29·4
Wun	39·5	26·3	—	—	39·5	26·3
Basim	41·5	23·7	32·8	22·2	40·4	23·7
Akola	40·9	33·9	35·0	23·7	41·5	33·9
Buldana	45·5	28·3	35·2	28·6	45·0	28·3
Means	42·2	28·9	35·3	26·1	43·2	28·8

There are 29 towns in the districts, and 133 registration circles. These ratios show that, either from differences in registration accuracy, or from local causes, the rural death-rates exceeded the town rates by 2·8 per 1,000. The total mean death-rate in this table is 0·6 per 1,000 under the rate given in the Report.

The Sanitary Commissioner has discussed the subject at greater length, but our present purpose is limited to the year's deaths and their removable causes.

4. *Death causes.*—These come under the following heads:—

Diseases.	Total Deaths.	Deaths per 1,000 of Population.
Cholera	3,573	1·4
Small-pox	369	·1
Fevers	39,340	15·0
Bowel complaints	13,546	5·2
Injuries	1,003	·4
All other causes	19,383	7·4
Total	77,214	29·4

This statement includes the population as a whole, but the census enables us to show the death-rates among different classes, as follows:—

Classes.	Population.	Deaths registered.	Deaths per 1,000.
Christians	1,330	13	9·8
Muhammadans	186,033	5,706	30·6
Hindus	2,311,614	60,380	26·1
Other classes	131,041	11,115	84·8
Total	2,630,018	77,214	29·4

The death causes are not given by classes in the returns.

5. We shall next discuss the facts connected with each death cause, beginning with cholera.

The following abstract shows the annual cholera deaths in comparison with the total annual deaths registered since 1868:—

Years.	Deaths, all Causes.		Deaths from Cholera.	
	Total.	Deaths per 1,000.	Total.	Deaths per 1,000.
1868	86,743	19·1	5,447	2·9
1869	47,338	22·8	10,947	5·2
1870	53,872	24·6	504	0·22
1871	38,725	17·7	581	0·2
1872	81,108	37·1	1,578	0·7
1873	49,896	22·8	—	—
1874	60,797	27·9	2	0·0009
1875	88,068	40·3	22,465	10·2
1876	69,832	31·9	2,682	1·2
1877	61,459	28·1	842	0·4
1878	178,404	81·5	34,306	15·6
1879	51,907	23·7	223	0·1
1880	51,725	23·6	1	0·0004
1881	76,661	29·1	3,404	1·3
1882	77,214	29·4	3,573	1·4

This abstract shows deficient registration generally in the earlier years, but approximately accurate registration of cholera deaths. The year of maximum mortality, 1878, was a year of great scarcity of food, and it is certain that it was the year of greatest cholera mortality. This epidemic, aided by want of food and the presence of local insanitary conditions, cut off 34,306 people, or a death-rate of 15·6 per 1,000. Cholera in Berar is a disease of sudden and violent outbursts and rapid subsidences, but, allowing for all this, it is by no means the most fatal epidemic incident to the province. In 1882, for every death from cholera there were above 10 deaths from fever, and during the entire 15 years, 1868 to 1882 inclusive, out of 1,033,150 deaths, 86,556 were from cholera, 43,939 from small-pox, and 473,015 from fevers. The relative mortality will be better shown by comparing the aggregate death-rates from epidemics for 14 years, 1868 to 1881, as follows:—

	Aggregate Death-rates per 1,000.
Cholera	38
Small-pox	20·78
Fever	195·9
Bowel complaints	86·2
All other causes	430·2

The reason for adducing these facts is simply to show that cholera epidemics are by no means the important death causes which their sudden fatality would lead us to expect, that they occupy an important but subordinate position in the epidemic history of Berar, and that the improvement of public health includes the mitigation of other fatal diseases besides cholera. Sanitary history concerns itself not only with the present, but with the past, in order to be better able to comprehend the extent and nature of its future work.

6. But to return to the cholera epidemic of 1882, from which 3,573 people died, the following was its monthly distribution:—

Months.	Deaths from Cholera.	Months.	Deaths from Cholera.
January	14	July	26
February	—	August	1,868
March	—	September	1,116
April	—	October	321
May	—	November	128
June	—	December	100

The 14 deaths in January occurred in Wun district, which has a population of 392,102. The other five districts escaped until July, when the true epidemic began, and it then affected all the districts. To all appearance the 14th January deaths belonged to the previous year's cholera, and the real epidemic would pass over to 1883.

7. Cholera mortality was divided between rural districts and towns in the following proportions:—The district population numbers 2,491,640, and it yielded 3,375 deaths from cholera in 1882, equal to 1·4 per 1,000. The towns returning cholera deaths had a population of 138,378, and registered 198 deaths, and a death-rate of 1·4 per 1,000, the same rate as ruled in the country districts. Both districts and towns showed considerable difference in the rates. In the former the rates were between 0·4 per 1,000 in Ellichpur, and 2·4 per 1,000 in Amraoti. Deulgaon Raja town had the lowest town death-rate from the epidemic, namely, 0·3 per 1,000, and Amraoti town 3·7 per 1,000, the highest.

The cholera of 1882 was very generally present over the provinces, for deaths were returned from 111 out of 133 circles of registration. There was, however, the same disposition to attack specific localities, as is shown by the fact that the cholera deaths all took place in 481 population groups, out of a total of 5,328 in the province.

8. It has been already shown that the epidemic really began in July, but that there were 14 deaths in January 1882. These 14 deaths took place in two registration circles in Wun district, contiguous to those parts of the Central Provinces where cholera prevailed epidemically in 1881. The affected circles, were, in fact, part of the same epidemic region. There was next an entire absence of deaths from cholera until the 20th July 1882, on which date the disease reappeared in another rural circle in Wun district, and within a few days thereafter it attacked other circles in Wun, Buldana, Akola, and Amraoti districts, none of the attacked points having been contiguous to Wun, but lying in the course which the epidemic was apparently following south-westward. On this subject the Sanitary Commissioner remarks, this westward movement of the epidemic was "unusual, and not "in accord with experience which would show that the disease, as a rule, always prevails in the "Khandeish district of Bombay Presidency to the west before it reaches us." The history of this epidemic presents points of considerable interest and importance, because the first cases appear to have been carefully investigated at the time, simply to arrive at the truth about them, and it may be useful to abstract the leading results obtained as follows.

9. As stated above there were 14 deaths in Wun district in January 1882. Of these the last death took place on the 21st January, the epidemic in this district having passed over from December 1881. It is remarkable that this district furnished a similar epidemic history in 1882. The first case of the true epidemic took place on the 20th July 1882, and during the remainder of the year the monthly deaths in Wun district were as follow:—

	Deaths.
July	8
August	309
September	317
October	40
November	44
December	28

The disease passed over into January 1883, and ended on the 22nd of that month, after having caused 30 additional deaths, so that we have here a distinct seven months' epidemic, covering a well defined area. It attacked 19 circles in Wun district out of 26, and 106 villages out of 1,139. The first fatal case in this district occurred on 20th July, and the next case on 25th July. It is necessary to keep these dates in mind, because the 20th of July case has an importation history, to the proper estimation of which dates are of importance.

On the 21st July, the day after the first Wun case took place, cholera appeared in Buldana district, in Chikhli rural circle. This circle is 110 miles west of Kulgaon and Digras circles in Wun, where the January cases took place, and 130 miles westward from Kalamb and Nandura rural circles, where the first cases took place in Wun district on the 20th and 25th July, the former of which was the imported case. But besides this, on the 23rd July the first case in Akola district took place in Shegaon rural circle, 100 miles from Kalamb in Wun, and on the same date the disease appeared in Takulkheda circle in Amraoti district, 60 miles to the north-west of the supposed imported case.

These facts clearly show that cholera was spread over nearly the entire area of Berar at the time the importation took place, and by themselves they would apparently class the imported case among coincidences, for it is quite certain that the subject of this case was not the only one who had arrived from the Central Provinces, but she was apparently the only arrival who was attacked.

10. Let us next see what was the nature of the locality at which she arrived from the Central Provinces. It is thus described by the civil surgeon:—"On reaching Ashti I observed the road "from Madin, a bazaar village, was occupied by a running stream, the water of which entered the "village nullah. On each side of this stream almost the whole village resorted for purposes of "nature; dead animal remains, bones, ordure, &c., were washed down this stream into the nullah, "which, when overflowed, filled two pits immediately behind the Mahar's huts. One pit contained "all the refuse of the town, animal and fæcal matter, the other pit contained festering heaps of "rubbish collected for burning bricks." To this account the Sanitary Commissioner adds, "The "cases first attacked lived near these pits, the stench from which was so intolerable that one could

" scarcely stand to windward of them. The water-supply of these first cases was from a well polluted " with the overflow water of the pits." We have in this importation case two preliminary facts, namely, epidemic extension over the country, and local conditions quite sufficient to supply the spark required to light the fire. Let us now state the importation case.

11. A Mahar woman, an inhabitant of this village of Ashti, "had been to Nagpur in the Central " Provinces, and returned on the 19th (July) (her husband having brought her by forced marches " a distance of about 70 miles). On the day following her arrival in the village she was seized " with purging and vomiting, and died the same night." We have here another predisposing condition added to the history, namely, fatigue, and the Sanitary Commissioner states that "there was no evidence that cholera was prevailing at Nagpur at the time." On the 25th July, the woman's son-in-law and his child, aged four years, were attacked and died. "The disease then spread throughout the village, attacked 97 persons, and caused 47 deaths."

The opinion that this woman's case was imported, and was the cause of the village outbreak, does not appear to have been held by any one except by the villagers.

In Nandura circle the village of Surwul yielded the second case of the year's epidemic. It lies 14 miles from Ashti, and there was no communication between the cases. The locality where this second case took place is described by the Sanitary Commissioner as follows:—"The streets were " found very clean, but in the compounds of houses were cesspools containing fæcal matter, emitting " offensive smells, and about the houses were decomposing dung-heaps. The village had been " flooded by heavy rains, and the overflow had passed into the wells, contaminating the drinking " water."

There is nothing peculiar in the facts. Wun district was invaded by cholera from the east, and there is no proof that the disease was imported by any one. The history merely shows that the first epidemic case occurred on 20th July under marked unwholesome local conditions.

12. As already stated, the second case took place next day at a distance of 110 miles in Buldana district, in Chikhli village, where a girl 11 years of age was attacked. This case was followed by others, as in the Wun example. "The civil surgeon who visited the village reported that the " origin of the case was indigenous, and that there had been no communication between these five " cases, who were of different castes and lived far apart."

The sanitary state of the village is described as follows:—"The general cleanliness of the village " is satisfactory, but the houses are terribly damp. The late unusually large rainfall and the situation " of the village in a basin prevents sufficiently quick surface drainage, although there is some attempt " at a system of drains." These Buldana cases proved the presence of cholera over the district, and the Government discouraged the holding of Deulgaon-Raja fair in consequence, but as the people nevertheless showed no disposition to keep away from it, steps were at once taken to place the locality in as good a sanitary state as possible before the people arrived, by active conservancy, providing proper latrines, and protecting watercourses. Over-crowding was prevented, and a cholera hospital provided. The usual attendance at the fair has been from 80,000 to 150,000, but on the present occasion the gathering "was the largest that has taken place for several years."

Only one case of cholera took place at the fair, which is held generally for about three weeks before the end of October. But it did not occur until the 31st October. There was a case in a man who was taken ill with diarrhœa on the road to the fair, and this became developed at the fair into cholera, from which the man recovered.

"Here," says the Sanitary Commissioner, "were two cases of epidemic cholera in the very midst " of a large concourse of people, yet though the cholera influence was present in the place, either at " the time or imported by these people, no spread of the disease occurred."

13. The first point in Akola district where cholera appeared was in the village of Gavan, in the Shegaon circle, on the 23rd July, three days after the first Wun case; it then attacked the surrounding villages and the town of Akola itself. There was no evidence whatever of importation, and it was an exception to find more than one case in a house "although as many as five slept and lived in the same room."

14. The fourth of these simultaneous cholera outbreaks was at Sirala village in Amraoti district on 23rd July. The patient, a man, was taken ill while working in his field. The disease then extended in the district, and was attributed by the people to a man who had not suffered, but was supposed to have been in contact with affected persons at Pandharpur, in Bombay, where cholera existed. But it turned out that there had been no cholera at this place.

The sanitary condition of the village where the first case took place "was very bad. Manure heaps " in and around the village, which was damp and dirty, with rain-water in pools and in the streets " and lanes. In front of the house of Jeysing, the first case attacked, there was a foul smelling water " hole, or, as described by the hospital assistant, a long ditch full of rotten water, cow-dung and " grass."

The next case took place in a village 12 miles away, and was also a local one. The village where it occurred is situated "on an elevation and near a river, with gutters for streets and dung-hills for " squares. The inside of the court-yards are also receptacles for filth. Near the well from which " the drinking water was obtained was a swampy dung-hill, the water from which must percolate " into the well."

15. We have given these first cases of four simultaneous outbreaks of cholera at four different points of these provinces many miles away from each other, because they show the absolute necessity of a careful inquiry into first cases, and the great advantage which accrues from following this course,

instead of trying to account for the facts on any general theory. If the first report of importation had been accepted as ground of action, then the remedy was unquestionably such a quarantine as would have stopped all intercourse, and the real facts and dates, together with the insanitary conditions under which the affected villages suffered, must have been ignored and indeed unknown. Now everything is plain enough, and we know that the most perfect quarantine measures could have effected not the least good; for the disease was already above 100 miles from the point where these measures should have been applied. And, moreover, we know what were the local conditions under which the disease swooped down on the affected localities, while the experience of Deulgaon-Raja fair has shown how cholera was kept from extending among a great concourse of people, by timely application of simple common sense sanitary proceedings. The practical result, therefore, is, that these poor people should be saved from similar visitations by having their villages and houses cleansed and kept clean, and their water-supply protected from pollution.

16. It is not necessary to discuss the cholera history further, because these first cases and their surroundings are typical of the remainder, and point to the same remedial measures, and we shall conclude these remarks by citing the last opinion on the subject, which, unfortunately for Indian sanitary work, we shall ever receive from Dr. Little:—"Putting aside, then, all theories as to the "origin and propagation of cholera, it must be admitted, in the light of the above facts, that clean- "liness, pure air, pure water, and good drainage are the most likely preventives we can employ "against this terrible disease, which, when once it has seized upon the human body, runs its own "course irrespective of any known remedy or reputed specific."

17. *Small-pox.*—Increase of small-pox deaths co-existed with decrease of deaths from cholera, and the following abstract shows that towards the end of 1882 small-pox was assuming an epidemic character, instead of its usual summer increase:—

Months.	Small-pox Deaths.	Months.	Small-pox Deaths.
January	21	July	29
February	22	August	21
March	42	September	5
April	30	October	10
May	17	November	28
June	15	December	122

The total year's deaths were 369, of which 231 took place under 12 years of age, and 128 under one year. The death-rate, 0·1 per 1,000, was equally divided between males and females, and it was exactly one-tenth of the preceding five years' average rate.

Small-pox existed in all the six districts during some parts of the year, but in one district, Akola, every month furnished deaths. Of 133 circles of registration 40 yielded deaths, but all the deaths were returned from no more than 95 villages out of a total of 5,238 in the provinces.

Divided between town and country districts small-pox was fivefold more fatal in the former than in the latter. The town rate equalled ·5 per 1,000, and the country rate ·1 per 1,000.

18. For a number of years past considerable progress has been made in extending vaccination among the people, and the next abstract enables us to compare the small-pox mortality with the vaccination.

Years.	Small-pox Death-rate per 1,000 of Population.	Ratio per Cent. of successful Vaccinations to Births.
1869	3·6	24·6
1870	·63	13·2
1871	·20	29·2
1872	3·8	38·5
1873	3·8	58·5
1874	·5	41·6
1875	·4	58·5
1876	·2	63·7
1877	2·9	77·6
1878	2·7	81·1
1879	·03	71·9
1880	·02	73·8
1881	·1	—
1882	·1	—

This abstract shows that of recent years small-pox has been less fatal, while vaccination has been considerably extended. The total vaccinations during the last 14 years have amounted to 642,431, out of a population of about 2½ millions; but the proportion of different ages vaccinated is not stated. The death-ratios at different ages were 62 per cent. between 1 and 12 years, and 3 per cent. over 12 years. This result appears to show that there is room for a large increase of vaccination work at the younger ages. The preceding abstract shows two years of low mortality, following one year,

1869, of high mortality; next two years of high mortality, followed by three years of low mortality; then follow two epidemic years, during which the death-rates had fallen, and then four years up to 1882, during which the small-pox death-rate was lowest of all. It appears probable that part of the decrease may be due to vaccination; but the Sanitary Commissioner very properly gives a caution against assuming that vaccination can stay an invading small-pox epidemic, which, "like a cholera epidemic, will follow its own course." Vaccination, so far as can be judged from Indian experience, is only one sanitary measure among many others which are needed to diminish the liability of the people to epidemic diseases.

19. *Fevers.*—In a preceding table we have stated the fever deaths in the provinces at 39,340, equal to a death-rate of 15 per 1,000 of the population, or more than half the total mortality. The deaths from fever among males to the corresponding deaths among females may be taken as 21 to 18. As usually happens, all the districts returned fever deaths, as did also all the 133 registration circles. But all the population groups did not register fever deaths, although 4,207 of these groups out of 5,238 did so. The registered fever death-rate in the country circles was 15·1 per 1,000, and in the towns 12·6 per 1,000, a difference which may possibly admit of being accounted for by better diagnosis in the town groups. Any way the fever registration cannot be depended on, for reasons we have often stated; namely, that fatal diseases with heat of skin are often entered under the fever heading. There can be no doubt, however, as stated by the Sanitary Commissioner, that malarial fever is the chief death cause in Berar as elsewhere in India.

20. Fever death-rates vary considerably in different districts, as will be seen by the following facts:—

Districts.	Fever Deaths per 1,000.	
	2. 188	Previous Five Years.
Amraoti	14·9	17·5
Ellichpur	15·3	18·8
Wun	21·3	20·1
Basim	10·0	11·7
Akola	16·4	19·0
Buldana	11·2	14·7
Total	15·0	17·1

There are obviously persistent differences in fever death-rates in different districts, and such differences form an important basis on which to rest local sanitary inquiries. There must be reasons, climatic, topographical, and local, for the differences, and we would suggest, by way of trial, an exhaustive local examination, engineering as well as sanitary, into the causes of such differences in rates as exist in Wun and Basim, for example.

Similar differences present themselves in the towns whose average fever-rate is 12·6 per 1,000, while the town rates vary between 2·8 per 1,000 in Basim town, with a population of 11,576, and 25·9 per 1,000 in Akot town among 16,137 people. There must be reasons for all this, and upon discovery of these reasons efficient sanitary work to a large extent depends.

21. As a contribution to the discussion of climatic causes, we shall here extract the monthly elements of climate for the whole area of Berar, and place with them the monthly deaths from fever and cholera.

Months.	Temperatures.			Rain.	Cholera Deaths.	Fever Deaths.
	Max.	Min.	Mean.			
				Inches.		
January	83·5	56·4	69·9	·74	14	3,176
February	85·8	58·1	71·9	—	—	2,752
March	96·3	69·0	82·9	—	—	3,020
April	69·3	55·1	62·2	·03	—	3,187
May	102·0	77·2	89·6	·23	—	3,169
June	88·1	71·6	79·8	11·38	—	2,110
July	80·3	69·9	75·1	13·15	26	2,519
August	82·8	69·3	76·05	4·99	1,868	4,182
September	83·6	69·7	76·6	7·91	1,116	4,763
October	87·8	65·3	76·5	·10	321	3,680
November	81·0	59·1	70·05	·96	128	3,563
December	82·4	56·4	69·4	—	100	3,219

These average climatic data appear to be scarcely sufficient to account for the statistical facts. It is true that increase of fever followed increase of rain, and continued into the drying-up period of the year, but as regards cholera, we have a distinct epidemic outburst during the rain, which continued after any effective rainfall had ceased; but these climatic data will not account for the very various fever and cholera death-rates in different districts and towns. The presumption, therefore, is that local peculiarities of rainfall and topography lent their aid in causing different

local death-rates. There is a diagram in the Report showing the relation of rainfall in inches to the monthly fever deaths in each district, but the monthly ratios to population are the data required. All we can do is to call attention to the facts, and suggest local inquiry.

22. The next abstract shows the annual fever mortality from 1868 to 1882.

Years.	Fever Deaths.	Years.	Fever Deaths.
1868	10,936	1876	39,875
1869	12,917	1877	34,453
1870	23,023	1878	85,260
1871	18,125	1879	32,475
1872	31,853	1880	31,027
1873	19,242	1881	41,681
1874	26,732	1882	39,340
1875	26,076		

The great fever death-rate of 1878 was connected with the famine. There is an apparent increase in the later years above the average fever mortality, but this is no doubt partly due to improved registration.

23. We shall return to the subject of local causes. But in the meantime the following remarks of the Sanitary Commissioner will give a general idea of what they are:—"Our Indian fevers are "most prevalent after heavy rains have water-logged the subsoil, . . . and for which the "remedy is drainage. In some of our large towns drainage schemes are in progress, and will be "urged on to completion. In our *smaller* towns and villages, however, but little has yet been done "in this direction. For villages a deep cutting, to answer as a drainage channel where water is "likely to lodge, is what has been recommended, and though the people could do this themselves, "still it requires to be done under direction."

24. *Bowel complaints.*—Fatal cases registered under this heading are still subject to important errors in classification, as has been hitherto the case, and the returns can be accepted as only partially correct.

The monthly deaths in 1882 were as follow:—

Months.	Bowel Complaint Deaths.	Months.	Bowel Complaint Deaths.
January	829	July	1,159
February	791	August	2,427
March	797	September	2,077
April	784	October	1,242
May	919	November	966
June	704	December	851

The total registered deaths from "bowel complaints" (chiefly diarrhœa and dysentery) were 13,546, or 5·1 per 1,000 of the population, exactly the same ratio as ruled during the preceding five years. It would appear as if a certain average error in diagnosis had established itself, for these diseases showed very different ratios of mortality in different districts. Deaths from them were returned from all the districts, but the ratios differed from ·6 per 1,000 in Wun district to 8·3 per 1,000 in Akola district, which last had a death-rate during the previous five years under this head of 9 per 1,000. These simple facts suggest the necessity of local inquiry. There must be some reason for the differences which have prevailed for many years. If these diverse death-rates are due to errors in diagnosis, it would at least be advantageous to be informed in what the error consists.

Out of 133 registration circles bowel complaint deaths were returned from 127. But out of 5,238 villages, all the deaths were returned from 1,954. Bowel complaints may be expected to become less fatal as sanitary work advances, but we would suggest whether some special inquiry might not be carried out in Akola district, for it is just possible that local reasons may exist for part of this great rate (8·3 per 1,000) there. As regards the towns, the question may be asked why, for instance, Akot town should have a bowel complaint death-rate of 9·1 per 1,000, and Akola town, in the same district, a rate of 1·2 per 1,000.

25. *Injuries.*—Deaths from various classes of injuries were as follow:—

Suicides	152
Wounding, &c.	639
Snake-bite and wild beasts	212
Total	1,003 = ·4 per 1,000.

The mean annual deaths under the head of "Snake-bite and wild beasts" amounted to 243, a little over the number of 1882.

26. *Other causes* yielded 19,383 deaths, or 7·4 per 1,000 of the population, so that the causes of 25 per cent. of the total year's deaths are unknown.

27. *Sanitary Works (Civil).*—The total expenditure under the head of sanitary improvements in Berar in 1882 was as follows:—

	Civil Stations.	Municipal Towns.	Non-Municipal Towns.	Villages.	Total.
	£	£	£	£	£
Conservancy	266	2,975	1,792	544	5,577
Drainage	320	800	377	896	2,393
Water-supply	188	435	349	2,154	3,126
Other sanitary improvements	832	1,001	841	472	3,146
Total 1882	1,606	5,211	3,359	4,066	14,242

The sum spent on sanitary work is not large, but it shows a certain appreciation of the necessities of the case. As we have often said, however, the main village improvements, except, perhaps, providing new water-sources, can all be done by the people themselves. Outlay has been incurred for current sanitary work rather than for new works, but, nevertheless, some advance appears to have been made in providing new works.

28. The town of *Khamgaon* is providing a water-supply of 20 gallons per head per day for a population of 12,400. No account of the work is given, but it will cost about 17,000*l.*

29. *Amraoti* is to receive a water-supply of 20 gallons per head per day for a population of 25,000. It is to be supplied from a tank and drainage area of 3·3 square miles. The estimated outlay is 27,886*l.* The water will be distributed by pipes into the town, but the method of partial delivery by dipping wells should be avoided altogether. It is intended to put up hydrants 500 feet apart, and with such a water-supply there ought to be the necessary means of distributing the water in a pure state, either by hydrants or by cisterns above ground, with suitable taps. Dipping wells are simply a modification of the ordinary Indian well, and water in them is subject to all the usual sources of surface impurity and foul drawing vessels and ropes.

In Amraoti municipal town surface drains have been extended, conservancy arrangements have been improved. "The waterworks now in progress will be a great boon to this town."

30. *Ellichpur.*—"No regular system of drainage. Rain-water is carried off by side cuttings, and waste water from the houses runs into cesspits, which are emptied periodically." It is not unlikely that part of the great death-rate of this town may be due to polluted subsoil. Its death-rate in 1882 was 26·5 per 1,000, and its previous five years' average rate was 40·1 per 1,000.

31. *Akola.*—Surface drains, to the extent of 6,090 feet, have been provided, and "the town has been surveyed with the view of systematically carrying the drainage scheme to completion." Water-supply is abundant, and the conservancy has been improved.

32. *Khamgaon.*—The new town drains "are open masonry surface drains, and carry off all sullage water from the houses, which before used to stagnate in cesspits and sink into the soil." The new water-supply will afford ample water for everything, but care should be taken that all refuse water is removed at once from the town site. Conservancy well carried out.

33. *Shegaon.*—This small town had been under the Municipal Act for a year. But the funds were limited. Some drains were repaired, dust bins were erected, and a few latrines provided.

34. It can scarcely be said that the works in municipal towns have been on an extensive scale during the year; and that great need exists for more activity in this important matter is shown by the death-rates of 11 towns in the returns, which amounted in the aggregate average to 29·7 per 1,000 against 35·7 per 1,000 on the average of five previous years. The rates in five of these towns exceeded 4 per cent., and all except one were above 25 per 1,000 on an average of the previous five years.

35. *General Remarks.*—Under this head are included inspection reports drawn up by the Sanitary Commissioner. They contain a considerable amount of useful information of local interest, and as some of the statements involve general principles, we shall extract them as illustrating the nature of epidemic disease causes in India as well as in Berar. Take, for example, the town of Akola, with a population of 16,614, and a five years' average death-rate of 46 per 1,000. For draining this town deep surface masonry drains were being provided, difficult to keep clean. Shallow saucer-sectioned drains were proposed, but objected to by the executive engineer on the ground that there was not sufficient water to flush them, and he proposed underground drains instead. All house sullage was to run into the shallow surface drains, and so into shallow sectioned main drains to the river.

36. The question raised in the discussion is simply whether cesspits should be continued and kept out of sight, or whether cesspool matter should be passed into surface drains with deficient water for flushing. Clearly the real question is that of water-supply. With the concentrated flow of closed pipe drains much less water suffices for cleansing than is required for shallow surface drains; but in either case there must be sufficient water, and then the question arises as to the comparative sanitary advantages of each class of drains. We have stated the points which require consideration in our suggestions for the sanitary improvement of Indian stations, and it may be stated generally that the safest way to dispose of household excreta in cases where closed drains

are not adopted, is to make provision in the sanitary administration for collecting and removing daily all household sewage, and in this case the ordinary refuse water of households might be passed into properly laid impervious surface drains to keep it out of the subsoil, and to pass it by the aid of water to an outfall. In some Indian towns water for this purpose is raised specially from wells. Water for the purpose at Akola might possibly be obtained from the river. It will be seen that in no case is it advised that cesspool matter from a town or large village population should be passed into open surface drains in the public highways. The advantage of a closed system of drains with sufficient water is, that it solves all the difficulties, especially if the sewage be applied for agricultural purposes.

The present report shows conclusively that until some such system of drainage combined with water-supply is adopted for Akola, there must be great improvements in the conservancy. All cesspits and privy wells should be filled up forthwith, and cesspool matter collected and removed for application as manure by hand.

37. A very unsatisfactory account is given of the civil station of Akola. The house compounds are made the places of deposit of sewage. "There are no latrines, and no arrangements made for the removal of house refuse." I noticed, says the Sanitary Commissioner, "some heaps of stable "sweepings thrown on the side of the public road. The native servants resort to pits just in "front of these quarters, and empty the house night-soil into them also. These pits were caused "by digging unorum for the roads." All these unwholesome practices ought to cease under a proper conservancy system; but, he continues, the municipal authorities "want experience and guidance." So far as can be judged of from other reports, this want is a general one, and ought, as far as possible, to be supplied by the Sanitary Commissioner and his assistants.

38. Local civil authorities can lend efficient aid in sanitary work, as in the instance of Khamgaon town, where "Mr. Dunlop has been indefatigable in his endeavours to improve this town, and it must be a source of much satisfaction to him to see his efforts so far crowned with success." But in this instance, as in Akola, the house drainage system appears to constitute the chief difficulty. The present position of this matter is as follows:—"House moris, or cesspits, which were the great "sanitary defect in this town, are being done away with, and the house sullage, instead of running "into pervious cesspools, thus causing corruption of the soil, and creating numerous foci of disease, "is now being run into these open saucer drains, and carried outside the town. The great "advantage of open saucer drains is that it can be seen at a glance whether they are clean or not, "and whether the sweepers are doing their duty. Closed drains get clogged with filth and refuse, "and being out of sight are also very often out of mind until they become utter abominations, "poisoning the air with noxious gases." Both of these positions may be sustained as correct. As we have stated in the case of Akola, all depends on the water supply, and also on good primary execution and subsequent oversight. Latrine matter is removed by hand labour, but urine is permitted to mingle with other refuse water, and is passed into the street drains, the reason being not that it is considered the best arrangement, but because the municipality do not wish to undertake the separation on the score of extra expense.

39. The question of adopting the best method of house drainage is also closely connected with the number of inhabitants. The population of Akola is 16,614, and of Khamgaon 12,390, and in either case considerable latitude might be allowed in deciding on the drainage system. But the case is otherwise with large cities, where, on the score of economy, an efficient system of house water-supply with proper house drainage would be more economical than the large and constant expense which would have to be incurred for an equally efficient method of hand cleansing.

40. In the course of the year a number of villages were inspected with this practical result, that the great remedy against epidemics in all of them is cleansing, keeping clean, and the provision of pure water. Their condition is described as follows:—

"A great defect in the conservancy arrangements of these villages is the number of dung-heaps "found either inside or at every few paces all round the outskirts. These dung-heaps, when "saturated by rain, ferment and decompose, and the resulting foul exhalations from them pollute "the air circulating through the village, and thus generate disease. In addition to polluting the "air, these dung-heaps also foul the water of the wells, for in the rains the surface drainage "dissolves much of the deleterious salts contained in the manure which, along with the lighter "particles of the heaps, find their way into the wells." Much of this universal prevalence of filth is due to the practice of stalling cattle inside villages, or even inside houses. In one village of about 2,000 inhabitants 2,000 cattle are stalled.

These village facts are quite sufficient to account for all the epidemic severity with which the rural districts of Berar are visited, and they also clearly indicate the sanitary measures required for protecting the lives of the people. Rules for their application have been circulated; but, so far as the information goes, they have been only feebly responded to. Local disease causes, whether in towns or villages, have been generally investigated; but, in view of the very great diversity in epidemic death-rates in different towns and districts, some technical local inquiries, including local drainage defects, appear to be required. But, above all things, more activity in turning to account the knowledge we at present possess is the remedy required, and this is our general conclusion from Dr. Little's latest and last contribution to the practical sanitary history of these provinces.

7th April 1884.

No. 9.

Memorandum of the Army Sanitary Commission on the Report of the Sanitary Commissioner for Assam for 1882.

1. The year 1882 was marked by an important extension of registration in Assam. This was part of an improved system, which, however, did not come into full operation until the 1st July, and consequently the data are only available for the last six months of 1882, during which the registration of births was effected for the first time in two plain districts, Sylhet and Cachar, which previously only returned deaths, while returns both of births and deaths were made for two hill districts, Khasi and Jaintia hills and Garo hills, for the first time. In subsequent years, therefore, we may expect registration returns for the whole of Assam except for the population of Naga hills, which does not at present admit of being brought under any general system of record.

2. The population from which returns both of births and deaths were obtained for the completed year 1882 was 2,225,271. The population from which death returns only were received for the whole year and birth returns for the latter half of it was 2,258,434, and the population which made returns of births and deaths only for the last six months of 1882 was 44,229.

The birth registration in the last group was carried out only in selected areas. We may, however, expect that in future years births and deaths will be registered among 4,527,934 people, or virtually for the whole population. A beginning of this important work had been made, and it is satisfactory to learn that no insurmountable difficulties have been encountered in it, and that our recommendation for introducing registration into tea-gardens had been carried out.

3. The results of birth and death registration for 1882, taken on the census population of 1881, stood as follows:—

Population returning Births for the whole year 1882.	Birth-rate per 1,000 of Population.
2,225,271	26·34

Population returning Deaths for the whole year 1882.	Death-rate per 1,000 of Population.
4,483,705	25·85

It is clear that the registration of births is defective, and no explanation short of this would account for the facts; but it is at the same time satisfactory to see how much really good registration work had been done in the course of the year.

4. The following abstract gives the census population and area for each district, together with the birth and death registration results for 1882:—

Districts.	Population, 1881.	Area in Square Miles.	Births per 1,000.		Deaths per 1,000.	
			1882.	Last Six Months 1882.	1882.	Last Six Months 1882.
Goalpara	446,282	3,897	32·69	—	32·94	—
Kamrup	644,960	3,631	27·65	—	32·88	—
Nowgong	310,579	3,417	22·97	—	26·14	—
Darrang	273,333	3,418	22·34	—	29·03	—
Sibsagar	370,274	2,855	27·48	—	23·95	—
Lakhimpur	179,893	3,723	15·44	—	14·74	—
Sylhet	1,969,009	5,440	—	11·19	23·59	—
Cachar	289,425	1,285	—	14·	20·66	—
Khasi and Jaintia Hills	43,485	—	—	17·98	—	16·14
Garo Hills	744	—	—	32·25	—	—

This abstract shows precisely the state of the registration at the commencement of the new decennial census period. The six months' columns will disappear in 1883, and thenceforth the whole province will make returns annually, but the registration in hill districts will, in the meantime, only represent the ratios of births and deaths in selected areas. As the figures stand, they show deficiency to a considerable extent in the birth registration in certain districts, but otherwise good registration work.

5. *Births.*—The first six districts in the table for which a year's birth-rates are given had a census population in 1882 of 2,225,271, and births stood as follow:—

Males	30,194
Females	28,432
Total	58,626

The remaining population was 2,302,663, and from among these there were the following births recorded during the last six months of 1882 :—

Males	13,697
Females	13,212
Total	26,909

The birth-rate for the first series was 26·34 per 1,000 for the year, and for the second series 11·68 per 1,000 for the last six months of 1882.

6. *Deaths.*—The preceding table shows that deaths were returned for a whole year for eight districts with a population of 4,483,705, and for one district for six months. The year's deaths in the eight districts were as follow :—

Males	61,678
Females	54,242
Total	115,920

The six months' deaths returned from the Khasi and Jaintia hills were, of—

Males	373
Females	329
Total	702

The year's death-rate for the first group was 25·85 per 1,000, and the six months' rate for the hill district was 16·14 per 1,000.

The ratios of births and deaths, according to sex, and for the districts where a year's data are available, were as follow :—

Males born per 100 females	106·19
„ died „	113·70

Similar ratios of births and deaths have been registered all over India, and if correct, would show a gradual decrease of males. They are, however, the result of incomplete registration. A similar circumstance may probably account for about 41½ per cent. of the deaths being returned at and under five years of age.

7. The next abstract gives briefly, the vital statistics of different classes in Assam :—

Classes.	Population.	Death-rates per 1,000 in 1882.
Mahomedans	1,812,220	23·89
Hindus	2,626,383	22·27
Christians	4,289	22·85
Other classes	138,813	129·56
Total	4,483,705	25·85

8. There are nine towns in the eight districts with a conjoint population of 62,211. Their death-rate in 1882 was 29·48 per 1,000. The district death-rate, apart from that of the towns, was 25·80 per 1,000 against a five years' mean of 11·30 per 1,000, affording another proof that registration is improving and that a more correct estimate of the sanitary state of the population is gradually being arrived at. This conclusion is further sustained by the following registered deaths for the last three years :—

1880	51,666
1881	71,941
1882	115,920

We shall next discuss the causes of these deaths.

9. *Causes of death.*—The following were the classified death causes in 1882 :—

	Deaths.
Cholera	21,055
Small-pox	3,195
Fevers	60,218
Bowel complaints	14,074
Injuries	1,150
All other causes	16,228
Total registered deaths	115,920

10. *Cholera.*—There can be little doubt that the deaths in this abstract ascribed to cholera are approximately correct. In the two preceding years the deaths under the same head were 2,803 and 5,010 respectively. It is not improbable, however, that many deaths from cholera escaped registration in these years; any way, the cholera death-rate of 1882, which was 4·69 per 1,000, was very high, and it was apparently related to the great epidemic of cholera which existed over the whole area of Bengal in the same year. In one district, Kamrup, with a population of 644,960, above a third of the whole cholera mortality of the year took place. In this district 7,896 people died of cholera, equal to a ratio of 12·24 per 1,000. Deaths from cholera were registered in all the districts of Assam and in all the nine towns. The death ratio in the districts was 4·69, and in the towns 5·33 per 1,000. The epidemic attacked 3,082 villages out of 18,701, and deaths from it were returned from 314 out of 686 circles of registration, thereby affording a striking confirmation of a law of cholera diffusion to which we long ago called attention, namely, that the intensity of an epidemic is represented not only by the number of deaths in each locality, but by the number of localities attacked.

Even in Kamrup district, which suffered so severely that the cholera deaths averaged 10 per attacked village, 777 villages were attacked, and 1,785 escaped the disease. The epidemic in Kamrup district was made up of 777 endemic seizures in separate localities. If, on the other hand, we take the case of Goalpara district, with a population of 436,642, which had a cholera death-rate of ·91 per 1,000, and Lakhimpur, whose population of 172,740 yielded a cholera death-rate of ·53 per 1,000, we find that, although 13 out of 23 circles of registration in Goalpara district returned deaths, only 54 villages out of 1,225 suffered. These 54 villages yielded 406 deaths from cholera, or about 8 deaths per attacked village on an average. In the same way in Lakhimpur district cholera deaths were returned from 9 registration circles out of 108, and from 14 villages out of 1,100. There were in all 96 deaths from cholera, averaging about 7 per attacked village.

11. The next abstract shows the deaths from cholera registered month by month for the province:—

Months.	Cholera Deaths.	Months.	Cholera Deaths.
January - - -	1,017	July - - -	1,611
February - -	869	August - - -	608
March - - -	1,701	September - -	384
April - - -	1,916	October - - -	863
May - - -	4,952	November - -	1,757
June - - -	3,583	December - -	2,694

This table shows the overlapping of two epidemics, one in the Bramahputra valley, which culminated in April, May, June, and July, the other in the Surma valley towards the end of the year, and probably passing over into next year. No general comparison can be made between the total cholera mortality and rainfall for this reason; but the Sanitary Commissioner has made a useful addition to cholera history in 1882, by placing the rainfall of head-quarter towns alongside the cholera deaths in the same districts, and from his tables the following results have been tabulated:—

Months.	Kamrup.		Nowgong.		Sibsagar.		Sylhet.		Cachar.	
	Cholera Deaths.	Rain.	Cholera Deaths.	Rain.	Cholera Deaths.	Rain.	Cholera Deaths.	Rain.	Cholera Deaths.	Rain.
		Ins.		Ins.		Ins.		Ins.		Ins.
January - - -	588	0·03	8	·48	2	1·63	356	—	50	·29
February - - -	333	1·29	9	1·65	1	2·82	460	2·84	59	3·78
March - - - -	709	4·69	87	4·85	—	5·19	751	13·77	111	14·05
April - - -	968	2·39	198	3·51	3	8·98	574	18·82	61	6·97
May - - -	2,745	7·91	447	11·85	29	4·02	272	23·85	177	18·93
June - - -	1,790	8·79	796	11·26	130	9·29	456	27·76	134	24·68
July - - - -	505	7·58	536	5·96	161	10·26	112	12·60	75	9·28
August - - -	102	15·00	173	13·55	33	15·13	151	44·92	31	17·79
September - - -	62	2·45	8	5·15	14	12·08	180	17·68	63	7·22
October - - - -	47	13·26	1	12·04	12	10·33	719	14·81	72	5·62
November - - -	17	1·36	—	0·48	96	1·29	1,421	·10	207	·75
December - - -	35	—	12	0·29	273	·67	2,010	—	302	·04
Death-rate per 1,000 of population - - -	12·24	—	7·22	—	2·03	—	3·75	—	4·63	—
Rainfall - - - -	—	66·75	—	71·07	—	82·19	—	176·65	—	109·40

These five separate sets of observations show that the lowest cholera death-rates co-existed with the higher rainfalls of the year, and that the lower rainfalls had the higher death-rates. Taken by months, it may be concluded generally that increasing and cumulative rainfall was accompanied and followed by decline of cholera, and there is also an indication of rise in cholera death-rates with reduction of rain.

As the monthly temperatures and temperature ranges are not given, we have no means of estimating their relation to cholera mortality.

12. Some interesting information on topographical and local accompaniments of the epidemic are given, from which the following facts are abstracted:—

Barpeta thana, in Kamrup district, had a cholera death-rate of 23·60 per 1,000, in reference to which the medical officer remarks:—"Its natural features stamp it as a typically pestilence-stricken "region. Much of the land is periodically inundated; every rise in the level of the Brahmaputra "puts it under water. The subdivisional town, Barpeta, is a miniature mud Venice, its streets "during half the year being waterways for boats, by which communications are carried on. It is "densely populated, and in many parts highly cultivated."

Gauhati town was visited by a slight epidemic, which began by a single death in January, and another in February. It culminated in 38 deaths in May, and ended in three deaths in July. The medical officer states of this attack that "it seemed to miss the most insanitary and worse regions "of the station, and the poorer and most ill-provided of the inhabitants, while it entered the best "houses occupying the best sites, and struck down those persons surrounded apparently by the best "sanitary precautions the town is yet capable of.

"The regions chiefly attacked lay near the river, and their most accessible source of water supply "was the river, than which the town has no better, . . . I do not think that in this short "outbreak the water-supply entered as a factor." And there being thus no evident cause for the outbreak, he says: "The disease was imported and travelled along lines of communication chiefly in direction of the wind."

If sanitary conditions afforded no help towards accounting for this outbreak, neither will the contagion and importation theory. The imported case was taken ill and died on the 30th April:—"He sickened and died on the 30th of April." But cholera existed during the three preceding months in Gauhati as well as in Gauhati thana, and of the first supposed "infected" case, it is stated that "on the 29th a man living near by was seized and died," that is before the importing case was taken ill. There is thus no foundation for the supposed importation, neither is such an agency necessary to elucidate the facts, which were as follow:—

Kamrup district was the seat of a severe epidemic outbreak which was part of the year's cholera, and 7,986 people died in this district, of whom 57 died in Gauhati town, and 304 in the thana. Cholera was most severe along the river, a well-known aggravating locality. The sanitary account given of attacked places refers not to absolute sanitary condition at all, but to relative sanitary condition. It is quite possible for the more elevated positions to suffer and the low ones to escape. This is matter of knowledge, and extends to the behaviour of cholera for hundreds or even thousands of feet of elevation. What really is wanted in such apparently anomalous cases as the present is to examine and report minutely on the absolute sanitary condition of affected houses and districts, with the view of improving them. We have devoted more space to this discussion than it merits, because it belongs to a class which has done great injury to sanitary work in India as elsewhere, and the practical result is that such statements should never appear in sanitary reports intended for practical purposes. The remark of the Sanitary Commissioner that "it appears quite clear that the conditions "necessary for the development of the disease existed in the Pan Bazaar, it was the breeding ground "of the contagium, from thence it spread," affords no clue to the history. It should be shown that "contagium" exists, and what it is, and, moreover, that it can spread the disease and how it does it.

For practical purposes we cannot do with less than this. On the other hand, we know from experimental inquiry that cholera cannot be communicated to any of the lower animals, not even to monkeys, and there is no satisfactory proof of its having been communicated to human beings. Inferences in such questions are next door to errors, and in the present state, at least, of the inquiry into cholera, it is safer, so far as the interests of the public health are concerned, to leave them out of official reports.

In regard to cholera in *Sylhet*, Dr. Macnamara, the civil surgeon, says that it is never wholly absent from the district. "It is endemic and propagated locally, but it is also epidemic, and its "course can sometimes be traced. It is true no importation theory will account for it in all cases. "The difficulty I find is, while accepting the theories of its propagation as generally laid down, to "explain why it ever stops under all the insanitary conditions under which we suffer. I believe the "general wave of cholera in the district during the year took a south-westerly direction, following "the course of our two great rivers, and rarely going far from them except in cases where a con-"nexion could be traced" (cases not given). "It is easily understood why this should be so, as the "river banks are used as public latrines, and for the reception of half-burnt bodies." With reference to the opinion stated in this passage, that cholera spread in a south-westerly direction, it is not borne out by the statistics of which an abstract is given in paragraph 21. This table shows that cholera existed in all the districts in January, and that in all the months Kamrup, which is the most westerly district except Goalpara, suffered most. Cholera, indeed, shaded away from Kamrup to the north-west. Dr. Macnamara's observations point to the existence of cholera independent of conditions, as well as to the determining influence of local causes. This latter fact is more clearly stated by the civil surgeon in his report on Sylhet municipality, which he describes as "an area thrown, by the "perversity of its inhabitants, ignorant of the simplest principles of sanitation, into a number of "elevations and depressions, the former covered with decaying vegetation, and the latter filled with "decomposing sewage, while the whole is buried in an atmosphere so noisome as to be at times very "offensive to the sense of smell." To this the Deputy Commissioner replies:—"While horribly "insanitary, it has proved generally healthy, though in 1882 cholera has swollen our death-rate. "The insanitary condition of the town is admitted." Here we have the statement made that insanitary condition and health can exist together. This is, however, a mistake, for on turning to the statistics we find the death-rate of Sylhet town to have been 33·80 per 1,000, including 6·73 from

cholera, while for the previous five years the death-rate averaged 35·95 per 1,000, an enormous rate for a small population of 14,407. The Sanitary Commissioner himself adds the remark that on his late tour of inspection he "failed to find any sanitary improvement in this municipality during the year." The practical conclusion is obvious enough, namely, that steps should be taken to make the municipality discharge its duty.

The following extraordinary statement about cholera in Cachar district is made by the civil surgeon. There were 1,342 cholera deaths, equal to 4·63 per 1,000 of the population, and 172 villages out of 450 were attacked. The civil surgeon states that he "inspected several villages himself, and could "find out nothing definitely. At a place called Natwanpur there were 17 deaths. The outbreak "was traced to two Manipuris bringing cloth from Lakhipur, where cholera had prevailed, and "selling it to the coolies." No attempt whatever is made to justify this opinion as to importation, while every report has shown year after year that Assam villages are in the very worst sanitary condition, and the very spots where cholera would be likely to appear during an epidemic.

The Deputy Commissioner states that "the insanitary condition of the villages remains much the same," although some efforts have been made towards improving them. It is in this direction that means are to be found for mitigating the ravages of cholera, and not in quarantine for stopping the importation of cloth. We need scarcely say that the unsupported opinions about cholera contagion enunciated in India are gladly accepted by quarantinists in Europe as affording justification for their own equally unsupported opinions. The only suggestions that appear applicable to such cases is that all similarly unsupported theoretical notions should be struck out of civil surgeons' reports before any notice is taken of them.

13. *Small-pox.*—The following have been the death-rates from small-pox during the last three years:—

Years.	Small-pox Deaths.	Ratio per 1,000 of Population.
1880	2,239	·59
1881	3,129	·69
1882	3,195	·71

The next abstract shows the monthly small-pox deaths, and it includes, besides the number for 1882 already given, 2 deaths in Khasi and Jaintia hills district, 3,197 in all.

Months.	Small-pox deaths.	Months.	Small-pox deaths.
January	216	July	243
February	201	August	173
March	419	September	95
April	567	October	87
May	566	November	108
June	365	December	157

Small-pox was generally diffused over the province in 1882. All the districts returned deaths from it, but its attacks were local, and deaths were registered from 246 circles out of 686, and from 1,368 villages only out of 18,701. As usually happens in India, the hot months yielded most of the deaths.

No vaccination statistics are given, but there appears to have been a considerable increase of operations during the year.

The death-rate from small-pox in the towns slightly exceeded the country rate. It was ·85 per 1,000 for the former against ·71 for the latter.

14. *Fevers.*—As usually happens, the chief death cause of the year was registered under this head. Fever deaths were returned from all the districts, from 484 out of 686 circles of registration, and from 11,262 villages out of 18,701. The fever deaths were 60,218, distributed month by month as follows:—

Months.	Fever deaths.	Months.	Fever deaths.
January	4,973	July	5,758
February	3,919	August	4,780
March	3,922	September	4,998
April	4,317	October	5,452
May	4,927	November	5,793
June	5,219	December	5,160

Besides these monthly fever deaths there were 212 returned from Khasi and Jaintia and Garo hills, the total year's fever deaths were hence 60,430.

15. In a previous table we have given the statistics of cholera in relation to rainfall, and it may be useful to reproduce the climatic data to show their relation to fever mortality.

Months.	Kamrup.		Nowgong.		Sibsagar.		Sylhet.		Cachar.	
	Fever Deaths.	Rain.	Fever Deaths.	Rain.	Fever Deaths.	Rain.	Fever Deaths.	Rain.	Fever Deaths.	Rain.
		Ins.		Ins.		Ins.		Ins.		Ins.
January	927	0·03	321	0·48	271	1·63	1,862	—	176	·29
February	733	1·29	265	1·65	232	2·82	1,382	2·84	111	3·78
March	733	6·69	286	4·85	228	5·19	1,168	13·77	120	14·05
April	755	2·39	286	3·54	238	8·98	1,439	18·82	145	6·97
May	1,031	7·91	341	11·85	297	4·02	1,435	23·35	186	18·93
June	981	8·79	346	11·26	349	9·29	1,714	27·76	160	24·68
July	1,000	7·58	355	5·96	517	10·26	1,914	12·60	314	9·28
August	744	15·00	306	13·55	502	15·13	1,580	44·92	298	17·79
September	678	3·45	274	5·45	549	12·08	1,798	17·68	194	7·22
October	834	13·26	319	12·04	566	10·83	2,125	14·81	236	5·66
November	845	1·36	348	0·48	476	1·29	2,332	·10	240	·75
December	868	—	281	0·29	447	0·67	2,615	—	305	·04
Death-rate per 1,000 of population	15·70	—	11·98	—	12·61	—	10·35	—	8·58	—
Rainfall	—	66·75	—	71·07	—	82·19	—	176·65	—	109·40

This abstract shows a relation between rainfall and fever mortality to which topographical conditions appear to contribute. Assam fever mortality has never been so high as the fever death-rate returned from other provinces of India. The rate in 1882, namely, 13·43 per 1,000, was much higher than the previous five years' average, which was 6·09 per 1,000. It will be observed that the two districts, Sylhet and Cachar, which are among the wettest in India, returned the lowest fever death-rates. Water by itself does not raise fever death-rates, for these flooded districts were less affected by fever than Assam districts where the lowest rainfall took place.

We know from experience elsewhere, especially in the North-West Provinces, that in the existing state of irrigation and drainage works there, such rainfalls as those of Sylhet and Cachar would have led to the population being decimated by fever. Hence the state of the subsoil must have some relation to fever mortality. Simple flooding rather tends to lower epidemic death-rates, and in Assam and adjoining districts in Lower Bengal we know that when the surface of the country is under water cholera is as effectually extinguished as a fire would be.

Malaria is the product of heat, moisture, and vegetable decomposition, and in a country where it shows itself by its effects on public health, its extent can be reduced by lowering the water level and increasing subsoil water movement, and, here in Assam, a similar result follows from raising the water level until the surface is covered. Probably there is more movement of subsoil water in Sylhet and Cachar than in other fever-stricken regions, and then we have the fact shown in the preceding table that in both districts the fever mortality rises when rainfall is reduced and evaporation with temperature variability succeeds. Of course the influence of purely local causes in villages, such as damp subsoil, bad houses, filth, bad water, and excessive growth of jungle, must not be overlooked; but it is unlikely that there is such a difference in these elements in Sylhet and Cachar as to account for the lower fever death-rates; hence we must admit that under topographical and general climatic conditions in these districts excessive rainfall is beneficial to health, and the most probable reason of this circumstance is that there is better subsoil drainage and consequent cleansing of the subsoil and replenishing of water sources brought about by the heavy rainfall.

The practical result of this discussion, therefore, is that as we cannot lessen the rainfall, the best course to take is to improve drainage outlets where this can be done, and to improve the local drainage and other sanitary conditions of villages.

16. Before concluding our remarks of Assam fevers, we may notice briefly "a form of malarial "poisoning known among the natives as *kálá ázár*, or black sickness, from the darkened colour "which the skin assumes in chronic cases." The medical officer at Tura states "that it begins with "a high temperature, severe pains in the head and body, loss of appetite, and other symptoms of "general febrile conditions; fever sometimes of an aguish form, and sometimes fever without "remission for many days together. The spleen and the liver enlarge, the skin becomes gradually "darkened, and in advanced cases there often is hæmorrhage from the nose and gums, œdema of "the feet or general dropsy, is likewise common, and life ends by a combination of disordered "functions known as malarial cachexy." The Sanitary Commissioner does not consider this to be a new disease. The cases take place in the Garo hills, and have been known as they now appear for the last 20 years. He further says that "the localities chiefly in which the disease prevails "are those which combine all the conditions under which the most intense forms of malarial diseases "are produced. . . . . It is so inimical to life that large tracts of hill country are being "depopulated in consequence. The affected localities are those where the low densely-wooded Garo "hills join on to the low-lying central Assam plain. It extends also to some distance into the hill "country, where the lower outer ranges are overtopped by higher interior ranges, but among these "higher hills the disease is almost unknown. The villages where it is prevalent are often built in "the midst of dense jungle, which the sun cannot penetrate and where the air cannot have "access."

The disease is yet imperfectly known on account of local prejudices of the people, but so far as an opinion can be formed about it, this Garo fever is only an intense form of Terai fever taking place among people living under aggravated topographical and local Terai influences.

The remedies proposed by the Sanitary Commissioner are clearing, drainage, and other similar improvements, but he very properly points out that the partial annual clearings by the people living on the spot are a probable added cause of sickness.

In cases such as this, the best remedy would apparently be to treat the affected tracts as new country, to remove the people to the high ground until the country is cleared and cultivated. But the question suggests itself, whether the enforced depopulation of such an unpromising tract does not point to the best and cheapest remedy, namely, the emigration of the inhabitants?

17. In our memorandum on the Assam Report for 1880 we noticed six cases of enteric fever as having occurred among Khasias living in a very filthy village, Maokar, which had, nevertheless, been supplied wholly or partially with pure water; and, as the case appeared to be one in which the prevalent water etiology might be put to a test, we asked this pointed question, "Did the cases take place before or after the better water was introduced?" To this the Sanitary Commissioner replies as follows:—"Enteric fever among the people of Maokar occurred between the months of July and "November, *after* the introduction of the new water-supply into the suburbs or outskirts of the "village." But at that time the village itself does not appear to have had good water.

18. *Bowel complaints.*—Diseases registered under this head are returned from a larger comparative area in Assam than in any other province. In 1882 bowel complaint deaths were registered in 451 out of 686 circles, and out of 18,701 villages 5,172 returned bowel complaint deaths.

The monthly mortality from them was as follows:—

Months.	Bowel Complaint Deaths.	Months.	Bowel Complaint Deaths.
January	1,001	July	1,297
February	745	August	1,211
March	758	September	1,230
April	1,604	October	1,348
May	2,134	November	1,275
June	1,866	December	1,565

The total bowel complaint deaths of the year amounted to 14,074, or 3.13 per 1,000 of the population. The previous five years' rate had been 1·60 per 1,000, but this does not show more deaths under the heading in 1882, only much better registration. No account is given of the local causes of bowel complaints (chiefly diarrhœa and dysentery); but it may be fairly assumed that these are of the same general nature as prevail in all towns and villages.

19. *Injuries.*—Among deaths from injuries there were registered—

85 suicides.
797 wounds and accidents.
268 from snake-bite and wild beasts.

1,150 = ·26 per 1,000 of the population.

20. *Sanitary Works (Civil).*—Under this head are given returns of expenditure from 13 towns, municipalities, &c. The total amount was 5,656*l.*, and its objects were as follow, in round numbers:—

	£
Medical relief	297
Vaccination	46
Drainage	886
Water-supply	208
Conservancy	1,520
Disposal of dead	13
Roads and culverts	2,294
Markets and slaughterhouses	217
Village sites	22
All other sanitary improvements	152

Most of the year's expenditure, as will be seen, was laid out on useful sanitary work.

There are a few points in the municipal reports which are worthy of record. The *town* of *Shillong*, besides attending to conservancy and drainage, has had a constant water-supply introduced, which is derived "from the steep, grassy, uninhabited hill slopes above the Crinoline falls. Culti- "vation is prohibited on the watershed, and the whole area is strictly preserved by the Forest "Department." After discussion, it was decided by the municipality to adopt subsidiary reservoirs, "into which the pure filtered water would be flowing night and day," from which it was to be laid on at high pressure to the extent of 20 gallons per head per day. "Pipes were ordered from "England, and the head works, reservoirs, and filter beds constructed, and by June 1883 the water "will be laid on to the various houses in the civil station and to the bazaar." The cost was estimated at Rs. 12,984. An attempt was made unsuccessfully to raise this amount by loan, and the work was carried on by advances made by the local administration. The population of the

town of Shillong is given in the statistics at 3,606; so that if all the people are to benefit by this work the capital outlay will be about 7*s.* per head.

As a proof of the coldness of the climate in winter, it is stated that a water-pipe was burst by the frost in January.

The town of *Gauhati* will, it is hoped, be soon provided with a similar water-supply. The following scheme had been adopted by the Commissioners and commenced:—"The water is to be procured "from the Brahmaputra by sinking a well in the south bank of the river, and from it to be pumped "into a reservoir on a small hill, which will afford a head of about 70 feet above the town. Settling "and filter tanks are to be provided, and a service reservoir, namely, a deep circular tank with "concrete floor and brickwork sides, covered by a roof to exclude heat. . . . . The delivery "will be by the means of about 20 closed tanks furnished with draw-taps and by stand-pipes. "Private houses and Government buildings are to have their own supply pipes and taps." The daily supply will at first be 100,000 gallons, but this can be doubled without adding to the works. The estimated cost is Rs. 38,214. The population of the town was 11,695 in 1881, so that the capital outlay will be a little over 6*s.* 6*d.* per head. It would be a great advantage if we, at home, could have our water-supplies provided at such a rate. The advantages of pure water-supply are, however, not confined to the plain towns. Far away up in the Naga hills, at an elevation of 5,500 feet, is Kolima, where a native infantry regiment is now stationed, with a cantonment and civil station. Water is obtained from a mountain stream as a source. "Already settling tanks and filter beds have "been constructed, and a considerable quantity of iron piping brought up. From the filter beds "a main two-inch pipe will run into an iron cistern in the fort. From the cistern two branch pipes "will carry water, one to the civil lines, and one to the cantonment. On the branches will be "placed overflow cisterns at intervals, and these will furnish the water-supply to the whole "population," which is about 3,000, and the supply will be at the rate of six gallons per head. At several stations and towns sanitary work is being done, but nowhere on any large scale, and little progress has as yet been made in improving villages. It may be suggested that wherever water is conducted from a distance into any locality, provision should be made for draining it away again after use, otherwise increase of fever may follow its introduction.

21. *General Remarks.*—The most important part of these remarks applies to the question of coolie transport up the Brahmaputra, and to outbreaks of cholera on board the steamboats. It may now be considered as a settled point that the view originally held as to cholera-tainted water having been the cause of cholera on the voyages was erroneous. Water-supply on board coolie steamers is of unexceptionable quality, and the causes must be sought for elsewhere. So far as can be judged of by the facts stated in the present Report, these are of the following kind. Cholera is always more or less prevalent in districts from whence coolies arrive at the ports of embarkation, so that predisposition to cholera may be already present among them. The steam transports themselves appear to be kept in good sanitary condition, but in the course of upward voyages they move slowly up stream through districts where on both banks of the Brahmaputra cholera prevails, and in these districts the disease has been known to show itself in comparatively good houses, proving the existence of the epidemic and its activity along the river banks. It must also be remembered that epidemic intensity is a potent factor in cholera history as well as local insanitary conditions; and, bearing this in mind, it is not difficult to understand why these coolies, in passing slowly through a cholera infected district, should have furnished a certain number of fatal cases.

The voyage from Dhubri, in Goalpara district, at the western extremity of Assam, to Dibrugarh, in Lakhimpur district, in the far north-east, may be assumed at from 360 to 400 miles, and usually takes from 12 to 14 days. No doubt many who enter on the voyage have come from localities where cholera always exists, and on this account may have been to a certain extent under cholera influence, but in 1882 it is certain that they entered and passed through districts where cholera prevailed epidemically.

This fact is shown by comparing the cholera prevalence in river-side districts with cholera deaths on board coolie transports for the same months as follows:—

Months.	Deaths from Cholera.								
	Goalpárá.	Kamrup.	Nowgong.	Darrang.	Sibsagar.	Lakhimpur.	Date of Embarkation at Dhubri.	Numbers embarked.	Deaths from Cholera.
January	17	583	8	—	2	1	12th	384	—
February	39	382	9	23	1	5	1st, 9th, 16th, 23rd.	1,517	8
March	5	709	87	27	—	1	3rd to 22nd	1,325	33
April	29	958	198	81	3	2	4th to 17th	1,107	7
May	81	2,745	417	330	29	1	5th, 22nd, 24th.	846	4
June	126	1,790	796	146	130	5	21st	43	1
July	40	505	536	151	161	31	—	—	—
August	21	102	178	90	33	7	—	—	—
September	4	62	8	49	14	4	—	—	—
October	2	47	1	8	12	11	20th	90	1
November	2	17	—	4	96	10	—	—	—
December	40	35	12	4	273	18	29th	342	8

The districts affected by cholera in this table are arranged from west to north-east, and coolies proceeding from Dhubri to Debrugarh would pass successively through them up the river. The evidence is not all that would be desirable for arriving at the causes of attacks on board the transports, but this abstract points forcibly to local epidemic prevalence as an efficient cause. Not only coolies but passengers suffered. The vessels were frequently inspected during the voyages, and reported in good sanitary condition. So far as removable causes of this nature are concerned, there appears to be nothing requiring notice. There is, however, one matter not referred to, in regard to which some information would be of importance. How does it happen that in a voyage of 12 or 14 days' duration the death-rates should be so enormously greater on board these inland emigration vessels than they are among coolies on outward emigration voyages to foreign countries? In 1882 there were embarked at Dhubri 12,636 coolies for transport upwards, and among these there died within the fortnight 79, giving a yearly average of 150 per 1,000. Leaving out cholera altogether the annual death-rate from other causes would have been 30·4 per 1,000.

The discussions which have taken place of late years have tended to clear away mistakes, and to bring us nearer to the truth about this river cholera; and we would beg to suggest, as matter for inquiry, whether emigrants on board these coolie transports are as well cared for in the matter of area, space, and shelter, especially at night, as they would be on board emigrant ships going beyond sea. This appears to be the next point to be looked to, and as there are months when cholera is least present in the country, as well as months when it exists in severity, we may repeat the recommendation we have made in our Memorandum on last year's Report, that these river voyages should be arranged as far as practicable so as to avoid the cholera months.

There is one matter bearing on the personal liability of these coolies which is of interest, viz., that the disease attached itself to groups of people coming originally from the same locality, so that if certain batches had not been embarked on a steamer there would have been little or no cholera on board it.

22. It will be seen that most of the present year's Sanitary Report on Assam is taken up with the disease history, and that, except as regards new water-supply, the Sanitary Commissioner has been able to report comparatively little work done.

The Government in its Resolution on the Report states, that "there is unfortunately not much to "record. . . . . The great needs of towns in Assam are a proper system of conservancy and "a good water-supply. The former is exceptionally difficult of attainment in this Province, because "no sweeper caste, accustomed to the work, exists, and mehters have to be imported from Upper "India at a heavy cost." Certain popular objections, and filthy habits also, stand in the way of local improvements, but we are bound to state that none of these circumstances are peculiar to Assam. Both the Government and its Sanitary Commissioner are perfectly aware of the improvements required for towns and villages, and all that we can do is to urge as strongly as we can, on the facts of the disease history, that some organized effort should be made to cope with epidemics by removing their local causes as far as practicable.

21st February 1884.

No. 10.

Memorandum of the Army Sanitary Commission on the Report on the Sanitary Administration of British Burma for 1882.

1. It appears to be necessary to commence our notice of this Report on British Burma by quoting the following paragraph (81) of the Report itself:—"This office" (that of the Sanitary Commissioner) "was in charge of Deputy Surgeon-General William Pearl up to the 31st March. Dr. Kelly "held office from the 1st April to the 3rd July, since which date the undersigned (D. Sinclair, M.B.) "has had officiating charge."

To any one who knows what sanitary work really implies and includes, such a state of the administrative arrangements for a Province amounts simply to an acknowledgment that there is no sanitary organization except in name, and that it would be better to discontinue the present half-and-half procedure, because we should then know exactly what we had to deal with.

The system, not the officers, must bear the blame, and the present year's Report shows that although some reporting has been done for a few towns, the sanitary problem for the great bulk of the population has not received, and in all probability could not have received, that amount of attention which its importance demands from officers charged with other onerous duties.

2. A paragraph following the one we have quoted contains the following statement (83):—"It "would be useless to further encumber this Report with those observations or my recommendations "in detail. The sanitary circumstances of most Burman towns, including the large municipalities, "are identical; and, generally speaking, the observations applicable to one were applicable to all. "There is ample room in all for greater cleanliness. Roadside drains are substitutes for sewers "and unoccupied sites for cover for latrines. In densely-peopled parts cesspits or small split "bamboo enclosures with no pit whatever are the usual destination of ordure. The ground beneath "the houses is polluted by rubbish, including, in many cases, human discharges. These spaces

" are frequently enclosed and converted into piggeries or fowl-houses. Scrub jungle and herbage " is not kept as low as it should. Wells are insufficiently protected from surface water, and near " enough cesspits to be dangerous from underground communication. To keep them passable " during the south-west monsoons roads are raised above the house sites, the road embankments " dam back the water, and the sites or parterres are, many of them, at this season of the year, two " or three feet under water. The contents of cesspits and wells are now freely interchangeable. " . . . . Village sanitation alone is applicable; one of the most effective aids to which is the " education of the people themselves."

3. We accept this general statement of the Burmese sanitary problem as being instructive and useful so far as it goes, but its practical result is to point to the need of dealing with the details on some definite and continuous system; and it is quite clear that, if the Sanitary Commissioner is to be the head of any such organization, he will be of very questionable utility, if he is to be changed every year, or three times in one year, as is shown to have been the case in the present Report.

In previous Memoranda we have urged that a better arrangement of the duties should be made, so that both interests, medical and sanitary, should receive their due share of attention, bearing always in mind that continuous local experience is necessary to the efficient application of sanitary measures, and the necessity for some rearrangement of duties is clearly shown in the present Report.

With these remarks on the sanitary administrative arrangements, we shall proceed to discuss the facts bearing on the general sanitary condition of the province in 1882.

4. Excluding certain districts, from which accurate returns cannot at present be obtained, the population of British Burma in 1881 consisted of—

Males	1,952,530
Females	1,711,393
Total	3,663,923

Of this population, 425,775 were located in 20 towns, and 3,238,148 in country villages, of which there are 14,942; facts which prove that Burmese sanitary work is essentially village work, and that the present proceedings in the towns, if all were successfully terminated, would leave the bulk of the population without sanitary care.

The population of 1881 was made up of the following classes:—

Mahomedans	168,766
Hindus	87,902
Christians	83,604
Burmese or Buddhists	3,217,023
Other classes	106,628
Total	3,663,923

The Census population of 1881 showed an increase of no less than 35 per cent. over the population of 1872, much of this large increase being apparently due to immigration into British territory.

5. The births in 1882 were of—

Males	41,781
Females	39,067
Total	80,848

If the whole 10 years' births were added to the Census population of 1872, and no deaths deducted, the total would still fall short of the Census number of 1881.

6. The following deaths were registered in 1881:—

Males	32,509
Females	26,637
Total	59,146

The death-rate was 16·44 per 1,000, and the birth-rate was 22·07 per 1,000, so that if both rates were reliable there would have been an addition to the population of the province in 1881 of 5·93 per 1,000.

Registered death-rates differed materially in towns and in country districts. In the 20 towns the death-rate from all causes in 1882 averaged 26·02 per 1,000 against a previous five years' average of 30·14 per 1,000. In the 15 districts, on the other hand, the death-rate in 1882 was only 14·84 per 1,000 against a previous five years' average of 14·80.

Registration appears to be better done in town than in country circles. In both, the figures probably represent the registration accuracy already attained rather than the actual facts. But, no doubt, the registration machinery is improving.

The town death-rate of 26·02 per 1,000 was under the five years' average, which was 30·14 per 1,000. The lowest rate, 16·84 per 1,000, was returned from Thyetmyo, and the highest, 39·2 per 1,000, from Pantanaw. The Thyetmyo death-rate was apparently much under the truth, for its five years' average rate had been 31·62 per 1,000.

7. The following were the census data for 1881, together with the areas and death-rates for 1882 and preceding five years, for each rural district, excluding towns:—

Districts.	Area in Square Miles.	Population 1881.	Death-rates.		Villages in Districts.
			1882.	Previous Five Years.	
Akyab	5,535	325,717	18·93	19·20	1,929
Kyoukpyoo	4,309	149,303	19·76	20·39	937
Sandoway	3,667	64,010	16·89	20·51	469
Hanthawaddy	3,106	420,667	13·41	15·99	1,382
Tharrawaddy	1,198	271,044	9·90	No data	1,045
Prome	2,010	260,914	17·96	14·50	1,548
Thonegwa	5,413	265,216	15·15	12·25	978
Bassein	5,833	349,365	15·17	12·19	1,644
Henzada	1,948	288,372	18·94	13·55	1,231
Thyetmyo	2,397	147,638	15·92	23·39	872
Amherst	15,203	301,086	8·42	10·96	1,021
Tavoy	7,150	71,616	16·85	12·04	291
Mergui	7,810	47,926	11·92	12·13	200
Shwaygyin	5,587	163,625	12·10	15·30	559
Toungoo	6,354	111,649	12·86	12·73	836
Totals	77,500	3,238,148	14·84	14·80	14,942

These statistical data, together with the data for the 20 towns and their population of 425,775, show at the commencement of a new decennial census period the nature of the sanitary and registration problems which have to be dealt with in Burma, and we have introduced them here to show the need of a far more efficient superintendence of sanitary work than can be afforded by frequent change of the sanitary authority. We admit the difficulties, but our duty is to point out the apparent inadequacy of the means at present in use for dealing with the obvious necessities of the case.

8. *Chief death causes in* 1882:—

Diseases.	Total Deaths, 1882.	Deaths per 1,000.	
		1882.	Five Years' Average.
Cholera	7,177	1·96	1·52
Small-pox	770	0·21	0·77
Fevers	27,093	7·39	8·70
Bowel complaints	3,291	0·90	1·43
Injuries	601	0·16	4·18
All other causes	20,214	5·52	
Total	59,146	16·24	16·60

These data, like those already adduced, appear to show rather an average condition of the registration than a definite statistical account of the sanitary history of this Province.

We shall next give a brief account of each death cause from the Sanitary Commissioner's Report.

9. *Cholera.*—The death-rate from cholera in the towns exceeded the country rate by 1 per 1,000. It was 2·84 in the former districts, and 1·84 in the latter. The total rate varies considerably in different years, as is shown by the following annual abstract of deaths for 11 years. But, so far as the registered deaths show, there is not the same tendency to regular periods of increase and decrease as take place in India.

Years.	Cholera Deaths.	Years.	Deaths.
1872	640	1878	6,759
1873	8,109	1879	1,828
1874	960	1880	2,638
1875	761	1881	5,239
1876	3,678	1882	7,177
1877	7,276		

Allowance must apparently be made for defective reporting of cholera deaths, in arriving at an estimate of cholera mortality in individual years.

The epidemic of 1882 did not follow the same law of increase in all the districts, as is shown by the following monthly abstract of deaths in each division. The average monthly rainfall in each division is also given to show the relation between the two classes of data :—

Months, 1882.	Arakan.		Pegu.		Irrawaddy.		Tenasserim.	
	Deaths from Cholera.	Average Rainfall.	Deaths from Cholera.	Average Rainfall.	Deaths from Cholera.	Average Rainfall.	Deaths from Cholera.	Average Rainfall.
		Inches.		Inches.		Inches.		Inches.
January	1	0·4	102	—	54	—	157	0·24
February	—	—	8	1·63	137	0·43	39	0·68
March	—	—	55	—	283	—	38	2·15
April	—	3·16	270	2·20	290	1·22	78	5·47
May	2	10·79	104	5·74	374	5·28	62	11·73
June	—	55·63	125	10·77	478	13·90	24	39·6
July	42	55·16	782	17·36	478	12·82	24	42·2
August	159	42·9	429	18·89	122	11·53	35	34·82
September	183	17·40	88	19·88	55	11·4	114	26·76
October	145	8·46	49	6·64	61	4·27	246	11·2
November	103	1·75	87	1·32	175	1·16	236	2·81
December	403	2·45	142	0·68	383	0·19	245	—

This table does not show a constant relation between rainfall and cholera prevalence. In Pegu and Irrawaddy, cholera diminishes with heavy rain, but in the other two divisions it increases.

The monthly incidence of cholera for the whole province was as follows :—

Months.	Cholera Deaths.	Months.	Cholera Deaths.
January	314	July	1,326
February	184	August	745
March	376	September	450
April	638	October	561
May	542	November	601
June	627	December	373

When this table is compared with the divisional average rainfall there is an apparent diminution of mortality after the rains, but the data are uncertain, and the real effect of rain on the mortality from cholera and fever may have to be sought in very circumscribed localities in a country where the rainfall is excessive.

10. The incidence of cholera in 1882 presented the usual features. Deaths from it were returned from 143 circles of registration out of a total of 850; and 13 out of 15 registration districts registered deaths. Cholera was sown broadcast over the Province, but the whole 7,177 deaths were reported from no more than 232 population groups, while 14,710 escaped the disease. Out of 20 towns 19 were attacked, pointing clearly to the probable influence of locality and local causes.

These 19 town population groups yielded 1,211 deaths, while the whole country groups yielded 5,966 deaths.

11. It cannot be said that the Report under review gives an account of the circumstances attending this epidemic. Two or three remarks by medical officers are introduced, but they throw no light on the subject. There is one report by Dr. Dalzell, however, which may be quoted, because it gives the only information on the relation of local causes to cholera prevalence. It relates to Akyab. "There were 42 (43) deaths from cholera reported during the year. The number of "cases which actually occurred were not ascertained, as apparently deaths only were reported. "The origin of the disease is difficult to trace; as it occurred among the residents, there was no "evidence of importation. One isolated case occurred in January, and the disease did not make its "appearance again till May, when another single death was reported. I am strongly inclined to the "belief that neither of these were cases of real cholera. In September the disease broke out "in the form of a circumscribed and local epidemic in the Mawleepara division of the town. I "visited several of the houses where the disease first occurred, and satisfied myself as to its true "nature and extent, and endeavoured to ascertain its cause. I found the locality (which was "extremely crowded) in a very filthy condition; the drains were choked up with sewage matter, and "the enclosures were in a swampy and unwholesome condition; the state of the well in one of these "compounds has already been described in a previous paragraph. I at once communicated the "result of my investigations to the magistrate, and recommended that a gang of conservancy coolies "should be sent to the spot, with orders to clean the drains and remove filth and rubbish from the "neighbourhood of the affected locality, and also that the well above alluded to should be closed. "My recommendations were promptly carried out, and we had the satisfaction of seeing the "epidemic gradually die out." The medical officer evidently did what he could, but the question

for the sanitary administration is simply this, "Why was it not all done before?" Why was it necessary to wait until this foul state of matters had done its work before the "conservancy coolies" were sent into the locality?

12. *Small-pox.*—The following abstract gives the deaths from small-pox in Burma since 1872:—

Years.	Small-pox Deaths.	Years.	Small-pox Deaths.
1872	845	1878	1,406
1873	1,416	1879	2,297
1874	1,191	1880	5,402
1875	752	1881	1,766
1876	1,335	1882	770
1877	1,230		

In 1882 these 770 small-pox deaths were returned from all the 15 districts, with two exceptions, Tavoy and Mergui; but out of 850 circles of registration only 30 reported deaths, and these deaths all took place in 35 villages out of 14,942 in the Province. It would hence appear that the year's mortality was due to 35 endemic outbreaks of small-pox, in which the average deaths exceeded the high proportion of 20 per village or population group. The country circles yielded 651 deaths, 0·20 per 1,000 of population; and the towns, six of which out of 20 returned deaths, had 119 casualties from this disease, or in the ratio of 0·28 per 1,000.

The monthly mortality in 1882 was as follows:—

Months.	Small-pox Deaths.	Months.	Small-pox Deaths.
January	70	July	43
February	75	August	41
March	97	September	38
April	95	October	32
May	120	November	47
June	91	December	21

13. The vaccination establishment for the official year 1882–83 consisted of—

Superintendent General	1
Superintendents of circles	17
Native ditto	4
Vaccinators, 1st class	17
Ditto, 2nd class	45
Chuprasies, &c.	2
Total	86

The following was the relation of vaccinations to births:—

Births	80,848
Total vaccinations	55,095
Of which successful	44,704

or about 55 per cent. of the births.

The re-vaccinations were 2,713, of which 1,639 were successful. The vaccinations amounted to 12½ per 1,000 of population.

One of the tables gives the results of vaccination and small-pox for 5 years for each of the divisions of Burma, as follows:—

Divisions.	Population, 1881.	Average Ratio per 1,000 for Five Years.	
		Vaccinated.	Died of Small-pox.
Arakan	487,518	8·37	0·18
Pegu	1,162,393	19·97	1·46
Irrawaddy	1,161,119	9·79	0·88
Tenasserim	795,732	10·83	0·48

The results are not satisfactory. The successful vaccinations are apparently too few to show any influence on reduction of small-pox mortality, and it must also be borne in mind that medical officers complain of the prevalence of inoculation in their districts. The most practical suggestion as regards small-pox is one made by the civil surgeon of Akyab. He proposes to appoint officers of

circles to do the vaccination work, to conduct the registration, and to attend to sanitation. But the Sanitary Commissioner, while admitting the importance of the proposal, says that the cost would be prohibitory.

This proposal, nevertheless, includes a principle for which we have often contended, namely, that the vaccination staff should do sanitary inspecting and advising work for villages while on their tours of duty.

14. *Fevers.*—In dealing with the fever mortality, the usual difficulty about diagnosis recurs in Burma as elsewhere in the East. The present Report repeats the statement that deaths preceded by heat are classed as fevers. As we have suggested before now, it might get over the difficulty if persons charged with registration were directed to include under the term "fever" only those cases attended by paroxysms.

Fever deaths in country districts were 23,487 in number, or 7·25 per 1·000 of the population. In the towns, 3,606 fever deaths, or 8·47 per 1,000, were registered. The fever death-rate for the whole Province was 7·39 per 1,000,—a very low rate, even if we take no account of errors in diagnosis.

15. The Sanitary Commissioner has given the following table, showing the monthly relation of fever deaths to climate:—

Months.	Fever Deaths.	Humidity Average.	Mean Temperature.			Rainfall.
			Max.	Min.	Range.	
			°	°		Inches.
January	2,212	69·77	86·15	60·58	27·7	0·19
February	1,806	64·15	89·44	63·48	26·1	0·72
March	1,757	55·90	94·17	69·02	24·6	0·42
April	1,714	60·22	94·93	74·04	20·2	3·45
May	1,725	87·22	91·84	75·34	15·4	9·45
June	2,111	85·77	87·39	75·35	14·7	32·35
July	2,737	86·77	85·31	75·22	9·6	34·27
August	2,784	88·31	85·24	74·86	9·9	28·97
September	2,674	84·15	86·56	75·02	11·3	20·70
October	2,421	82·85	87·86	74·83	12·9	8·39
November	2,431	74·59	87·45	71·26	16·3	2·09
December	2,676	68·38	86·51	65·31	21·4	0·73

The most humid months, and those with highest rainfall accompanied by heat, were the months of highest fever mortality. Temperature range appears to have exercised no influence on this, except at the end of the year.

Deaths from fever were reported from all the districts, and from 564 out of 850 circles of registration. Fever covered the whole area of the country, more or less, but it was nevertheless strictly endemic, for the whole fever mortality of the year was yielded by 1,377 out of 14,942 population groups. On several occasions we have called attention to the low fever death-rate of Burma, but these facts appear to show that the real cause of this apparent low rate may be due to bad registration. Why should the whole death-rate have been yielded by less than a tenth of the population groups, and why should upwards of nine tenths have escaped? The fever causes, as the table show, were operative over the entire area of the Province, and yet we have the anomaly of their being inoperative, so far as mortality is concerned, for nine tenths of the population probably.

The only statement of local causes is the following:—"As in the previous year, July, August, " and September was the quarter which returns the greatest mortality. At that season, the whole " country, especially the delta, is water-logged; water in wells rises to within a foot or two of the " surface; atmospheric humidity is then most pronounced." If the registration were more reliable, this question might admit of further discussion, but we have shown that the foundation facts are wanting. As the case stands, the delta districts by no means yield the highest death-rates from fever.

The year's rate, as already stated, for the whole Province was 7·39 per 1,000 against a previous five years' ratio of 8·70 per 1,000. The delta districts had a fever rate for the year of 5·93 per 1,000, and the north-western sea-side districts of 13·23 per 1,000, viz., where the rainfall is heaviest the fever death-rate is highest. The rainfall in 1882 was there about 200 inches.

16. *Bowel complaints* yielded 3,291 deaths in 1882, or 0·90 per 1,000 of the population, against a previous five years' annual average of 1·43 per 1,000. Of these deaths 864 took place in the towns, equal to a ratio of 2·03 per 1,000 of the town population; and 2,427, or a death-rate of 0·75 per 1,000 of population, were returned from country circles. But we have here the same anomaly as in other diseases, viz., that while cases of fatal bowel complaints were returned from all the districts, they were registered in 131 circles only out of 850 in the Province and from 148 villages out of 14,942. These facts show how much registration requires to be improved.

The following were the monthly deaths from diseases classed under this head :—

Months.	Bowel Complaint Deaths.	Months.	Bowel Complaint Deaths.
January - - -	329	July - - -	434
February - -	156	August - - -	483
March - - -	150	September - -	322
April - - -	221	October - - -	227
May - - -	239	November - -	234
June - - -	306	December - -	290

This table merely shows how many deaths were registered each month. Nothing else can be deduced from it.

17. *Injuries.*—Deaths registered under this title included 72 suicides, 323 wounds and accidents, and 206 deaths from snake-bite and wild beasts.

18. Under *all other causes* were registered 20,214 deaths, or nearly a third of the total mortality of the year.

The circumstances under which registration in Burma has to be carried out are of well known difficulty, and continuous efforts have been made to ensure greater accuracy of record and report, but from the facts we have dealt with, it will be seen that at present only a general idea of the disease history of this Province is available for sanitary work.

19. *Sanitary Works (Civil).*—Under this head are given a number of notes on sanitary works carried out during the year in certain of the towns, together with remarks on the registration as it exists at present. The details are without arrangement, and the general impression conveyed by them is that while vaccination and registration are considered necessary, especially the first of these, real sanitary work for the removal of disease causes is a matter not of primary importance, to say the least of it. All we can do with the data is to abstract from them such information as they contain on this subject.

Rangoon.—"The splendid waterworks by which the town is to receive an ample supply of pure "water have made rapid progress during the year, and will be soon completed. . . . The "executive engineer expects to have an almost unlimited supply of water by the end of August "1883." It has, however, been possible in the meantime to extend the supply to the town proper; and as drainage works had not proceeded *pari passu* with the water-supply, we are told that "there is an immense increase of the house sullage in consequence of the better supply of water "to the town. . . . . The open roadside drains are the channels through which most of it "flows; a vast amount is thrown on to the land in the drainage spaces, which, in consequence, are in "as bad, if not worse, condition than they were last year. In streets where the roadside drains are "not lined with bricks, there has been an aggravation of the evil, the sullage remaining in the "ditches stagnant and stinking. . . . . At present the roadside drains are the receptacles of urine "from stables, and often from coolie barracks, and of course there is in the dry weather much "ground of complaint from the stench thus caused." There is a drainage scheme in hand "which, it is hoped, will be started on the completion of the waterworks."

No information as to this proposed scheme is given in the present Report, and we can give no opinion about it, except that, with an almost unlimited water-supply, there ought to be no difficulty in laying down a drainage system sufficient to cleanse every house in the town, and to leave nothing to be carried away by hand labour except town sweepings and food refuse.

It is a fundamental principle of all town improvements that works of drainage should go on *pari passu* with the water-supply, to prevent the added water becoming an added disease cause. Such a state of matters as the following extract describes ought to cease when the town is drained:—"Some "improvements in the system of collecting house refuse is much needed. Stale rice, vegetables, "fish refuse, &c., are now either thrown into the drain in front of the house, or on the drainage "space." The present difficulties in dealing with public and private latrines ought also to disappear under a suitable drainage system.

Attention is pointedly called to evils of another kind, resulting from the large influx of Madras coolies as labourers into Rangoon. They are described as "the most dirty of the many various races "in this city, and the most difficult to deal with." The houses where they live "are always reeking "with filth, and generally are the centres of nuisances, bad smells, and diseases of their neighbour-"hood."

The following comment accompanies this statement:—"This is one of the numerous instances in "which the hands of the sanitary officer are tied by inefficient byelaws, framed under an Act which "has been pronounced by the legal adviser of the municipality and the magistrates to be inoperative." In other words, we have here an Act which practically arrests sanitary work. Why not rescind it, and pass another? No wonder there are so many weak places in the sanitary administration.

Akyak town.—No sanitary report. Municipal report (not given) stated to have been submitted by the President. Inhabitants of some villages have been instructed as to the necessity of sanitary precautions.

Bassein.—A few surface drainage improvements. Nothing else of consequence done. The income of this town of 5,355 inhabitants is stated at Rs. 7,800, and the expenditure at Rs. 14,000.

Sandoway.—Income, Rs. 14,600. Expenditure sanctioned for surface sanitary work, Rs. 460. "No public latrines; the river answers the requirements of the people in all respects." The river also receives all rubbish and sweepings.

Mergui.—Population, 8,633. Income, Rs. 7,145, most of which was spent on sanitary work, roads, wells, drains, conservancy. An original way of protecting wells is shown on a section. The well tube is raised about 5 feet above the ground, and surrounding this there is an outer wall half the height, leaving a circular space of about 3 feet between the walls, which is filled up with sand. It is not easy to see of what use this method can be, because it leaves the main cause of impure well water, the impure subsoil, where it was. In our "Suggestions" we have shown how this cause can be effectually dealt with.

Shwaygyin.—Population, 7,519. Income, Rs. 22,100. Expenditure, Rs. 29,500, of which Rs. 2,917 were spent on sanitary works, mainly conservancy. There are no public latrines. Cesspits are in use. Water-supply chiefly from wells. As we have often pointed out, wells under such conditions can never be safe as water sources unless all cesspits be abolished and filled up, and the whole sewage removed daily by hand labour.

Tavoy.—Population, 13,372. Expenditure for sanitary purposes, Rs. 2,513 out of Rs. 22,500 expended during the year. Surface work only done. Water-supply bad.

20. The sanitary information which it has been deemed sufficient to give about these smaller towns is practically reproduced in regard to the others of which any notice is taken. Drainage is provided for surface water only. Cesspits, wells dug in the same ground, and bad or indifferent water, appear to exist in most of them. Nevertheless, some current sanitary work is carried out in most of these towns, but all that can be said about them is that they are beginning to improve their sanitary condition. The chief large works in progress were the water-supply of Rangoon and the drainage and water-supply of Prome.

21. Municipal funds are now administered by committees, the majority of the members of which have been elected by the townsfolk. In the course of the year municipal committees were formed in 24 towns. Sanitary work is thus entering on a new phasis, and this is the time to systematize it, to prevent wrong courses being followed, and to exercise skilled supervision over the whole.

22. We would, in view of this change, strongly advise that the office of Sanitary Commissioner should cease to be held as a movable appointment. It is true that the work can be left to develop itself, and very probably in wrong and expensive directions; but if the Sanitary Commissioner is to be responsible for the supervision of the work under its altered conditions, it is clear that he must be able so to arrange his medical and sanitary duties as to gain knowledge and experience on the spot, and that village work should be placed under his supervision also. We have stated in our revised "Suggestions" the chief points to be attended to, both in towns and villages, and to them we must refer for practical details.

23. The main recommendation we have to make on the Report under review is what we have stated in regard to the need of efficient direction and supervision being bestowed on the work in such way as the Government may consider best. More attention might also be paid to systematic sanitary reporting, so that the precise state of towns and villages might be reproduced from time to time, bearing in mind that reporting is only a means to an end, and that the most acceptable reports are those which tell of good sanitary work done and lives saved.

18th January 1884.

No. 11.

Memorandum of the Army Sanitary Commission on the Sanitary, Vaccination, Dispensary, and Jail Report of Rajputana for 1882.

This Report is in the form of a selection from records of the Government of India, Foreign Department, and is not in the form adopted for the sanitary reports of Provinces. It, nevertheless, contains a number of important facts and particulars, which show that the public health movement is taking hold of opinion, and is not unlikely to make progress among the people at no distant date.

1. The vital statistics of Rajputana are based on the census of 1881, and are divided into two sections, Ajmere and the Native States. In the former the data are collected in the usual way, and in the Native States the data are supplied by the courtesy of the durbars, who in this matter are performing an important public service.

The Ajmere data are the more complete, and we hope that the details for the Native States will before long be brought up to the same standard.

2. The population of Ajmere and Merwara in 1881 stood as follows:—

Mahomedans	57,809
Hindus	400,337
Christians	—
Other classes	2,576
	460,722

The sexes of this population are not distinguished in the returns, but they are distinguished in the birth and death registration as follows:—

Births registered.	
Males	6,336
Females	5,520
Total	11,856 = 25·73 per 1,000.

Deaths registered.	
Males	4,761
Females	3,804
Total	8,565 = 18·59 per 1,000.

The previous five years' death-rate was 25·23 per 1,000, showing apparently some falling off in the death registration of 1882.

The death-rates per 1,000 registered among different classes were as follow:—

Mahomedans	15·65
Hindus	18·82
Other classes	1·94
Total	18·59

3. The following were the deaths registered under the usual headings in 1882 in Ajmere and Merwara:—

Death Causes.	Total Deaths.	Deaths per 1,000.
Cholera	289	0·63
Small-pox	718	1·56
Fever	5,380	11·68
Bowel complaints	810	1·76
Injuries	242	0·52
All other causes	1,126	2·44
All causes	8,565	18·59

We have shown in other memoranda that cholera prevailed as a severe epidemic over a large area of India, and Ajmere also suffered. During the previous year, 1881, there were only 16 cholera deaths in the Province; and while the cholera death-rate during the previous five years had been 0·16 per 1,000, the rate was 0·63, or nearly fourfold this average, in 1882. Out of 23 circles of registration, 15 returned cholera deaths; but, as usually happens in India, all the deaths were returned from no more than 38 population groups out of 739, or a little over 5 per cent. of the number.

4. The monthly distribution of cholera was as follows:—

Months.	Cholera Deaths.	Months.	Cholera Deaths.
January	—	July	61
February	—	August	103
March	1	September	69
April	6	October	—
May	3	November	—
June	48	December	—

These figures show that a distinct epidemic wave passed over the Province in the middle of the year.

The district population of 370,391 yielded 264 deaths from cholera, or in the ratio of 0·71 per 1,000; and the town population of 90,331 had 25 deaths, or 0·28 per 1,000. One of the towns, Pisangan, returned no deaths from cholera.

The epidemic fell with greatest severity on Ajmere rural district, where, out of 21,933 people, there were 138 deaths, or 6·29 per 1,000. This was the highest rate of the year. Ajmere town district had a rate of 5 per 1,000, but the town itself yielded 15 deaths out of a population of 40,559, or in the ratio of 0·37 per 1,000. The weight of the epidemic thus fell on the Ajmere circles, while the town itself comparatively escaped.

5. The following account of the Ajmere outbreak appears to have been carefully drawn up, and is worthy of quotation, as showing how cholera comported itself within a limited population where the facts could be ascertained:—"A death from cholera was reported by the police to have occurred "in the Kekri rural district, in the village of Oondri, on the 9th March. So far as can be "ascertained, this was the first case. On the 11th April two women arrived in Ajmere, very ill, "by rail from Ahmedabad, and died of cholera on the same day. The house where they lodged "was disinfected in the usual way. During the remainder of April, and throughout the whole "of May, no seizures took place in the vicinity of the city or in the rural district of Ajmere, "though seven deaths were reported by the police as having occurred during these months in towns "and villages at varying distances from the capital. On the 10th of June the disease appeared in "an epidemic form among some coolies, who were living in huts much overcrowded in the suburbs "of Ajmere. From this time fresh cases frequently occurred until the 18th August, from which "date cholera entirely disappeared from the city and its immediate neighbourhood. Cases continued "to occur in the outlying districts until the 26th September, after which date no more seizures took "place." Jails and troops escaped, a water carrier only having been attacked. No account is given of the localities where these cases occurred.

6. *Small-pox.*—Deaths from small-pox were registered in all the 23 circles, and in 164 villages out of 732 in Ajmere and Merwara. The towns were more severely affected by it than the rural circles. Out of a town population of 90,331 there were 148 small-pox deaths, or 1·64 per 1,000, while the country population yielded a rate of 1·54 per 1,000.

The year's rate for the whole Province was 1·56 per 1,000 against a previous five years' average of 2·58 per 1,000.

The monthly numbers of small-pox deaths stood as follow:—

Months.	Small-pox Deaths.	Months.	Small-pox Deaths.
January	42	July	52
February	36	August	24
March	89	September	7
April	152	October	7
May	146	November	20
June	113	December	36

7. The vaccination service consisted of six vaccinators, under superintendence of the Civil Surgeon and a Native Superintendent. The year's work consisted of 4,594 successful vaccinations, far from being equal to the births, which numbered 11,886.

8. *Fevers.*—As in other Governments of India, fevers were by far the most important death causes in Ajmere. There were 5,380 deaths assigned to this cause, equal to a death-rate of 11·68 per 1,000, against a previous five years' average of 15·31 per 1,000. All the 23 circles of registration returned fever deaths, and 704 villages out of 739 suffered. All the towns registered deaths from this cause.

No account is given of the local causes of fever; and the following monthly deaths appear to show that the amount of fever is not so strikingly influenced by merely climatic causes as it is in other districts of India; but there is still more fever in the drying-up season:—

Months.	Fever Deaths.	Months.	Fever Deaths.
January	481	July	356
February	365	August	569
March	345	September	618
April	335	October	541
May	368	November	499
June	334	December	569

There is nothing in the remainder of the year's disease history of Ajmere specially calling for notice.

9. *Native States.*—The census of 1881 was the first general enumeration made under British rule. The population of two states and five cities from which births and deaths have been returned amounted at that date to 1,294,319.

The registered births were of—

Males	4,283
Females	3,333
Total	7,616 = 5·88 per 1,000.

There were 14,941 deaths registered = a ratio of 11·54 per 1,000.
A very hopeful commencement has therefore been made in this important public work.
Deaths were registered as follows:—

Diseases.	Deaths.
Cholera	573
Small-pox	571
Fevers	4,935
Bowel complaints	535
Snake bite	34
Injuries	68
All others	8,225
	14,941

Vaccinations in the Native States are returned as 105,642 successful.

10. *Sanitation.*—In Ajmere division no sanitary work had been carried out. The method of cleansing had been under consideration by a local committee, which had decided that the town filth should be removed to a distance by rail, unless the cost stood in the way. Should this prove to be correct, some other means of removal would be adopted. The Ajmere water-supply scheme had been delayed on account of an accident during the rains, "and it is now uncertain" when the works will be completed.

The most satisfactory proceeding during the year appears to have been the examination of the vaccinators on Dr. Cuningham's sanitary primer, and these officials were instructed "to take every opportunity of spreading information regarding the laws of health among the villages."

11. A similar course has been adopted with the vaccinators in the Native States, and it is very satisfactory to be told that some movement in the way of improving the public health has begun in several localities. For example, in Jeypore the durbar has under consideration the introduction of the dry-earth system in combination with street tramways to facilitate the removal of sewage. The streets have been named; the houses numbered; some of the Ajmere registration forms have been introduced for births and deaths; and two city inspectors have been appointed. This city had a population of 142,578 in 1881, so that the introduction of conservancy on a definite plan among so many people is a work of no ordinary importance, and we must hope that the financial part of this proposal may be also met.

Ulwur city is a State capital, and has a population of 49,867. While attention has been paid to the city, the Surgeon-Major remarks that "special efforts were made this year to spread amongst the "people some knowledge of the importance to them of improvements in their sanitary surroundings. "Vaccinators were compelled to read up Surgeon-General Cuningham's Sanitary Primer, and to "show themselves able to explain to the villagers the broad principles it teaches. Tehsildars and "other district officers were instructed by circular from His Highness the Maharaja's office that they "were bound to see that some improvement in sanitary matters was stated in their respective "charges."

Attention was particularly called to the protection of drinking water from pollution, and of the necessity of marking off certain spots "to leeward of the village for manure heaps, and for the "purposes of nature. The Agency Surgeon states that during his tour he saw evidence "even in out-of-the-way places that these instructions were being attended to." His Highness the Maharaja was very properly thanked "for the substantial assistance afforded to the endeavour to "spread throughout the State some knowledge of the laws of health." A primer is about to be introduced into the State schools.

Of *Oodeypore* it is said that "the prevalence of cholera in this State during 1882 has not proved "an unmixed evil, for the epidemic had the effect of calling attention pointedly to some of the "sanitary requirements of the city." Refuse has been collected into heaps and burnt, and the ashes sold to cultivators. Vacant spaces have been set apart for purposes of nature, and for collecting manure, &c. Several surface drains have been made, and a jemadar, with a staff of 115 sweepers, has been appointed to attend to the sanitary arrangements. This city contains a population of 38,214. In other localities in these Native States similar work is being done. All this is matter of satisfaction, and we must hope that these examples may be followed in other places.

No doubt, as stated in the Report, old habits and customs are difficult to change, but the facts show that with care and judgment an important commencement in applying sound principles in practice has been already made.

12. *Jails.*—The average number of prisoners in the jails of Ajmere division was 495, and the death-rate in 1882 was 26 per 1,000. In the Native States the average prisoners amounted to 2,662, and the death-rate 36 per 1,000. Both rates are high, but the Native jail rate is the lowest of five years' rates.

It is worth while to place the rates side by side:—

Years.	Death-rates per 1,000.	
	Ajmere Jails.	Native Jails.
1878	45	160
1879	35	103
1880	10	48
1881	4	46
1882	26	36

The first year in the series was a scarcity year, during which there was a large increase of prisoners. There has been a continuous reduction of average inmates in the Native jails from 3,534, the maximum average in 1878 to 2,662, the lowest number in 1882. But in the Ajmere jails the number rose from 429 in 1881 to 495 in 1882. These facts appear to show that the element of crowding entered into the chain of causes of annual death-rates. It is satisfactory to learn that various sanitary improvements have been or are being effected in different jails. A new jail will be erected at Oodeypore, and another at Tonk. These are important improvements, for we are told that "since the occupation of the new jail at Kotah the number of fatal cases has steadily declined." 39 per cent. of the mortality in Native jails arose from bowel complaints, and 16 per cent. from malarial fevers.

13. *Dispensaries.*—These establishments are of a departmental character, and do not call for remark, but we cannot conclude this Memorandum without alluding to the provision made for sickness. We find from the tables, that in the Ajmere dispensaries there were treated in 1882, 740 indoor and 37,541 outdoor patients, while the Native States dispensaries treated 4,175 indoor and 275,066 outdoor cases.

14. In a former Memorandum we took exception to the small amount of public health work reported from Rajputana, but in the preceding paragraphs it has been shown that, although very much remains to be done to save the people from epidemics, there is evidence of commencing movement in this important work, and perhaps the most gratifying part of the Report is that which shows that the necessity of sanitary improvement is becoming recognized both by the people and by Native rulers.

3rd September 1884.

No. 12.

Memorandum of the Army Sanitary Commission on the Administration Report of the Commissioners of the Town of Calcutta for 1882–83.

1. In the following paragraphs we shall first give some account of the public health in Calcutta during the year 1882; and the first point which appears to require notice is the opening paragraph of the health officer's report, which states that, "in accordance with the provisions of Act I. (B.C.) of "1882, annual reports will for the future be prepared for the official year (ending 31st March) in "place of the calendar year as heretofore." This change in a current system of health statistics which prevails in all civilised states, and which, moreover, is in contradiction with the principles of statistical uniformity aimed at by the London International Statistical Congress, cannot be otherwise than matter of regret. Annual statistics of this class have to deal with scientific points alone, and have no relation to official convenience.

The year ending 31st March cannot be accepted as giving a true account of the public health and its relations to other elements, unless the whole of these elements were recalculated on this basis. In the present state of the law, the best course, apparently, to take would be to have two sets of figures, one for the calendar year, the other for the official year, and to print both.

2. The present year's Report gives the figures for 1882, with a supplement for the first quarter of 1883, from the 31st March, of which the statistics will be reckoned hereafter. These remarks apply to all the health statistics of India, and we have introduced them partly for the purpose of pointing out the injury which would arise from the Calcutta example being followed elsewhere.

3. The following table gives the population of Calcutta according to race for the 12 months of 1882:—

Race.	Population.		
	Males.	Females.	Total.
Non-Asiatics	9,193	4,658	13,851
Mixed races	4,515	4,389	8,904
Hindoos	189,684	98,678	288,362
Mahomedans	90,667	33,763	124,430
Other classes	4,358	2,314	7,282
Total	288,317	144,402	433,219

This table presents the usual anomaly of the male population being double that of females, showing, apparently, that many families live beyond municipal limits, while the husbands lodge in Calcutta for convenience of work. But the discrepancies between the sexes are partly due to the fact that in the preceding totals are included 3,002 males against 346 females in Fort William, and 28,037 males against 163 females in the Port population.

If both be deducted, the population of Calcutta registering sections will be:—

Males	257,778
Females	143,893
Total	401,671

4. Among this population the births registered in 1882 amounted to 7,505, or 17·3 per 1,000, and the deaths to 13,177, or 30·4 per 1,000, against 29·3 per 1,000, which was the previous 10 years' average.

This comparison is not a satisfactory one, but, even high as the rate is after the sanitary work which has been carried out, there is nevertheless abundant proof of the saving of life within the precincts of municipal Calcutta by comparing its death-rate with the rate which prevailed in 1882 among above 250,000 people in the suburbs beyond the influence of sanitary work. The deaths in the suburbs were 10,470, or 41·6 per 1,000; and this ratio showed a great reduction, chiefly in fevers, bowel complaints, and other causes, over the previous five years' suburban average, which was 53·8 per 1,000. Notwithstanding the higher town rate of 1882, it also showed a reduction over the previous five years' average, which was 31·3 per 1,000.

During the last year or two there have, we believe, been some improvements in bustees, water supply, &c. in hand by the suburban authorities, which may have been of service, but we have no means of knowing the facts.

5. The next abstract gives the death causes within municipal Calcutta, under the customary headings, for 1882 and 1881:—

Death Causes.	Total Deaths.	
	1882.	1881.
Cholera	2,240	1,693
Small-pox	17	133
Fevers	3,618	3,765
Bowel complaints	1,454	1,491
Injuries	236	5,948
All other causes	5,612	
All causes	13,177	13,030

There were 147 more deaths in 1882 than in 1881, partly accounted for by reductions as well as by augmentations. If we take the so-called zymotic diseases, we find in 1882 an increase of 547 cholera deaths, but a decrease of 116 deaths from small-pox, 147 from fevers, and 47 from bowel complaints. The decrease in these diseases was 310, against an increase of 547 from cholera.

There was an increase of 100 deaths under all other causes. We are thus brought to augmentation of cholera as the real cause in the rise of Calcutta death-rate, for if the cholera rate had been the same in both years the death-rate of 1882 would have been a shade lower than that of 1881. We

can go a step further in this analysis by comparing the cholera death-rates for the last five years in municipal and suburban Calcutta, which have stood as follow:—

Years.	Cholera Deaths per 1,000.	
	Calcutta.	Suburbs.
1878	3·0	9·3
1879	2·7	7·4
1880	4·8	8·8
1881	3·9	7·4
1882	5·7	9·3

This table affords evidence that, both in the improved and unimproved areas, the cholera mortality is determined by epidemic intensity as well as by local sanitary condition. But the influence of local causes on the mortality is strikingly shown at the same time by contrasting the annual rates of improved municipal Calcutta with the rates of the unimproved suburbs; and the practical lesson taught by the facts is that, whatever may be the intensity of a cholera invasion, the loss of life from it is greatly augmented by bad sanitary condition.

6. In our Memorandum on the Calcutta Report of 1881 we dwelt strongly on imperfect cleansing as a probable cause of increasing cholera mortality shown in the preceding table, but since that date there has been a great epidemic of cholera in Lower Bengal; in other words, there was in 1882 a notable increase of epidemic intensity, and municipal Calcutta showed the highest cholera death-rate of many past years.

The Officer of Health has shown that this increase included in it rural districts around Calcutta, and there is hence every reason to believe that the same lethal influence permeated the city and suburbs, and that their respective death-rates from cholera showed the results of their comparative insanitary conditions. The whole argument from the cholera of 1882 results in no discouragement so far as sanitary works are concerned. On the contrary, their efficacy in lessening pre-disposition among the inhabitants of municipal Calcutta to cholera when it is over the country has been satisfactorily established, while the experience affords every encouragement for pressing forwards every required improvement; and, as we formerly stated, the most important work, under present circumstances, is rigid attention to cleansing and keeping clean, and the speedy provision of wholesome water for the whole bustee population.

7. As the year 1882 was an epidemic year, it may be useful to give a tabular comparison between the chief climatic elements and the monthly cholera deaths as follows:—

Months.	Mean Temperature.	Temperature Range.	Humidity.	Rainfall.	Cholera Deaths.
				Inches.	
January	67·3	22·5	73	0·13	129
February	70·2	22·8	69	3·42	121
March	80·0	23·2	67	0·52	170
April	83·4	21·5	67	0·25	318
May	83·4	19·3	71	6·05	380
June	83·8	12·2	84	9·99	254
July	82·8	10·1	86	11·76	54
August	81·8	9·8	88	10·87	52
September	82·5	10·2	86	10·50	38
October	79·0	11·7	84	11·08	91
November	73·1	14·2	75	1·61	232
December	66·3	19·9	73	—	411
Mean, 1882	77·8	16·4	77	66·18	2,240
Mean of 24 years	79·2	—	75	66·38*	1,341†

*, Mean of 48 years. † Mean of 40 years.

This abstract shows increase of cholera deaths with rising temperature and little rain; great reduction of cholera mortality with increase of rain; great increase of cholera with cessation of rain and increasing range accompanying reduction of temperature. The element of air humidity appears to exert little influence on cholera, the actual amount of which appears to be more connected with the rainfall than with any other element.

8. We shall next trace the distribution of epidemic death-rates in different districts of Calcutta, selecting for this purpose cholera and fever, as being of most importance.

Registering Sections.	Population.	Persons per acre.	Deaths per 1,000.		
			Cholera.	Fevers.	All Causes.
Shampookur	25,487	78	6·1	8·8	35·9
Coomertooly	25,682	129	7·3	6·6	29·2
Bartollah	25,527	85	5·7	9·0	32·8
Sookia Street	20,572	89	5·8	8·5	35·4
Jorabagan	36,318	148	7·2	8·3	33·3
Jorasanko	32,824	131	6·1	9·0	37·1
Burra Bazaar	20,769	100	6·8	10·5	33·1
Colootolah	47,323	208	5·1	10·1	32·6
Moocheepara	39,241	148	5·3	8·0	30·0
Bow Bazaar	21,627	150	5·3	8·5	31·1
Puddopookur	20,516	124	4·3	8·1	30·5
Waterloo Street	5,785	28	3·9	5·1	17·6
Fenwick Bazaar	26,051	137	4·7	8·0	25·4
Taltollah	26,963	125	3·2	9·8	33·7
Colliaga	11,840	70	4·2	10·3	33·2
Park Street	4,968	26	2·0	5·6	16·7
Bamun Bustee	6,125	36	2·2	14·2	31·8
Hastings Street	4,953	87	6·0	13·7	40·9
Total	401,671	107	5·2	8·8	32·0
Fort William	3,348	—	2·6	3·9	18·5
Port of Calcutta	28,200	—	4·1	4·1	15·0
Grand Total	433,219	—	5·1	8·3	30·1

This abstract connects the death-rates with one element only, namely, crowding on the surface, but in some of the least crowded districts the population is of a better class than it is in the crowded areas, and, besides this, the condition of the subsoil and general sanitary state must be considered in estimating the influence of surface crowding.

Some of the densities are, no doubt, high, such, for example, as Colootolah, containing a population of 133,120 to the square mile, which is, nevertheless, below some home averages. All the district death-rates from all causes are high, except those for Park and Waterloo Streets. With the exception of five districts which had fever-rates at and above 10 per 1,000, none of the fever rates can be considered high for India, especially for a town population.

9. The general localizing causes of cholera in Calcutta have been so often discussed that it is unnecessary to do more in the present Memorandum than to quote the result of special instances where inquiry was made by the Officer of Health in 1882. He states as the year's experience, that "In all cases in which the disease presented any tendency to grouping special investigation was "made, and in every instance in which several cases had occurred in a house or village, or within "circumscribed limits, glaring insanitary defects were discovered,—a foul tank, obstructed drainage, "fœtid ditches, ill-kept byres, offensive latrines, and so forth. Numerous cases might be detailed in "support of this statement, but the conclusion forced upon me by all that I have seen of cholera "since I became Health Officer of Calcutta is that the disease flourishes in places and among com-"munities where cleanliness is neglected, and filth of all kinds allowed to lodge and fester in various "ways and under various circumstances."

10. *Fevers.*—The fever death-rate in Calcutta appears to be undergoing gradual reduction, as may be inferred from the following number of deaths registered in 11 successive years.

Years.	Registered Fever Deaths.	Years.	Registered Fever Deaths.
1872	4,895	1878	6,086
1873	4,632	1879	4,796
1874	4,461	1880	3,797
1875	5,328	1881	3,765
1876	4,361	1882	3,618
1877	5,154		

This abstract includes the augmented fever mortality for the scarcity years 1877–78, but the general result is satisfactory, and shows the benefit of improving the condition of the subsoil of towns by under drainage. The fever death-rate in Calcutta, including districts undrained or only partially drained, was 8·8 per 1,000, or about one-half of the rate for undrained suburban Calcutta, which was 16·7 per 1,000. It is now fully admitted that the prevalence of paroxysmal fevers, which are the main causes of Indian death-rates, is chiefly due to undrained subsoil in connexion with general neglect of house hygiene.

The Officer of Health had continued his inquiries into the alleged occurrence of enteric fever deaths among the native population of Calcutta, with the result stated, "that it is quite certain that enteric fever is a rare disease in Calcutta."

11. *Small-pox and Vaccination.*—There were only 17 small-pox deaths in 1882, but safety cannot be inferred from this small mortality, as the law of prevalence of small-pox in Calcutta is that of

severe recurring epidemics, with almost complete disappearance of the disease in the intervals. During the year 1882, there were 7,802 vaccinations and re-vaccinations performed, or above one thousand more than during the preceding year. It is worthy of remark that, while the small-pox death-rate was 0·04 per 1,000 in municipal Calcutta, it was 0·09 per 1,000 in the suburbs. In the same way, the death-rate from bowel complaints, which was below the average, notwithstanding the prevailing cholera epidemic, ruled at 3·5 per 1,000 in Calcutta against 5·1 in the suburbs. As the people are the same and are really part of the same community, the argument appears to lead to the conclusion that the municipal authorities in Calcutta have done good work, and it is very much to be desired that their example may be followed outside their limits.

We shall next give a brief outline of the sanitary work in Calcutta proper in 1882, beginning with the—

12. *Water-supply.*—We may here repeat what has been said on former occasions, that the water-supply of Calcutta is pumped out of the Hoogly at a sufficient distance above the town to be unaffected by tidal influences. It is first passed into subsidence reservoirs, where it is aerated; it is next filtered and conveyed in a 42-inch main to the pumping station at Tallah, where it is forced into the mains for supplying the town.

There is another pumping station at Wellington Square, where part of the water which has accumulated during the night is forced into the mains and thence distributed for use.

There is an unfiltered water-supply raised from the river near at hand, which is used solely for street watering, sewer flushing, and the like. It may be stated as matter of home experience that iron or steel water vans are best for street watering. With a strong horse, these vans might contain 450 gallons.

Portable flush tanks, where there is a water-supply and street hydrants, will be cheaper than fixed flush tanks for flushing tributary sewers or drains.

The filtered water only is supplied for domestic purposes. Its daily amount in 1882 was 7,824,576 gallons, showing a satisfactory increase of 616,123 gallons, or in all about 18 gallons per head per diem for the municipal population. The total connexions of premises with the water mains, up to 31st March 1883, amounted to 14,245, of which 859 were made during the preceding 15 months.

13. Calcutta appears to have an active staff of water inspectors, who made, during the 15 months, 28,773 house service inspections, on which they issued 3,083 notices of defects, which were remedied in one way or other. Besides this house work the inspectors examined personally 538 stand posts, 50 ground hydrants, and 41 cattle troughs, and ordered the necessary repairs. The cost levied for water inside the town was Re. 1 for 1,500 gallons.

With the exception of a few bursts, the whole machinery appears to have worked well during the year. The supply drawn for use at Barrackpore was 48,393 gallons per day, from storage capable of supplying 120,000 gallons per day.

14. The amount of unfiltered water for cleansing purposes averaged 1,838,725 gallons per day, which is distributed from 994 ground hydrants. This unfiltered water has also been supplied to 23 premises, four for privies, six for business, one for a latrine, and 12 for building purposes. It is a very obvious recommendation to make, that house supplies of this kind should be so provided as to prevent the use of unfiltered water for drinking or cooking. The supply of unfiltered water was being extended.

15. The filtered supply is not sufficient for the wants of the population, and further extension is under discussion. A needless question has been imported into the discussion, namely, the comparative advantages of open and closed conduits, because one of the axioms of water engineering is, that water once filtered should not again be exposed to any risk of impurity before it is delivered to the consumer. The practical result has been that the Commissioners have decided to lay down a second 48-inch main, to supply 8,000,000 gallons per day additional to the town and 4,000,000 gallons per day to the suburbs. This, though a very considerable improvement, is of course far below the wants of a quarter of a million of suburban population.

16. The corporation analyst, Mr. Pedler, has given an instructive account of the filtered water-supply for 1882, from which it appears that the quality and filtration have both been improving, although the quality is subject to the influence of dry weather and rainfall, affording in this matter a kind of index to the influence of climate on tank and well waters generally.

During dry weather the solids, including chlorine compounds, are all notably increased, until the rainy weather sets in to restore the balance. Perhaps the readiest way to show the quality of Calcutta water will be to place the average analyses of 1882 alongside the corresponding facts for London water as follows:—

	Calcutta Hydrant Water, 1882.	London Water Average, 1877.
Total solid impurity	16·91	31·00
Organic carbon	0·053	0·160
Organic nitrogen	0·035	0·024
Ammonia	—	—
Nitrogen (as nitrates and nitrites)	0·021	0·328
Total combined nitrogen	0·056	0·352
Chlorine	0·91	1·80
Total hardness	7·18	19·73

Out of 103 analyses made during the official year 1882–83, the water was colourless and transparent in 67. In 36 the filtration was imperfect, but all of these defects, except one, took place during a storm.

17. Although not part of his official report, we may quote the following statement from a lecture "On the Sanitary Past, Present, and Future of Calcutta," delivered by Dr. McLeod, the Calcutta Officer of Health, on the 10th April 1884, at the Bethune Society. He says, "In quality, the water "is declared by chemical analyses to be of unquestionable purity, and Dr. Koch's microscopic "researches recently confirmed the results of analyses." Unfortunately those who used this chemically and microscopically pure water did not all escape cholera, showing that this pestilence has other origins than bad water.

18. *Drainage.*—The chairman of the Commissioners, in his interesting account of the year's drainage work, alludes to the opposition formerly raised to the drainage of Calcutta on purely theoretical grounds, the truth of which has long been disproved by the result. The entire main brick sewers of the original scheme and some more appear to be completed. These had a projected length of 33·78 miles. The actual lengths constructed are 39·21 miles. The length of pipe sewers laid down up to 31st March 1883 was about 113 miles out of 154 in the original scheme.

The secondary drainage work, namely, widening lanes and obliteration of offensive surface drains, and providing man-holes, lamp-holes, gully grates, &c., has been pushed forward rapidly, so that during 1882 there were laid 476 feet of 15-inch sewer-pipe, 1,714 feet of 12-inch, 11,354 feet of 9-inch, and 83,200 feet of 6-inch pipes, in all 18·32 miles, with the requisite man-holes, lamp-holes, &c.

The work for the first quarter of 1883 amounted to 2·35 miles of similar pipe-sewers, so that the whole original scheme, with the exception of 15 miles of pipe-sewers, has been completed. There are few municipalities which can show so much work in the time. House drainage has also been making progress. The demand for house connexions depends on the street drainage, but in 1881–82 and the first quarter of 1883 there were 4,650 houses connected with the sewers. This work is done by authorised contractors under a staff of municipal inspectors. The drainage of bustees is also in hand.

19. The sewage is passed by gravitation to the pumping-station, and during a period of 15 months up to 31st March 1883 there were raised, on an average, daily, 15,514,886 gallons of sewage to an average height of 8·78 feet, to be discharged into the outfall. Now, it appears that the total daily water-supply, filtered and unfiltered, amounted at the same time to 9,663,301, hence, making no allowance for evaporation, which, however, is an important exit for water, the amount of sewage raised and discharged by pumping exceeded the total water-supply by 5,851,585 gallons, and to this extent the sewage system of Calcutta afforded daily relief to the low water-logged site it is built on.

20. Works of drainage and water-supply being now in a sufficiently advanced state to enable house improvements to be undertaken, we are glad to see that the municipality is determined to grapple with the all-important, though very difficult, question of *bustee improvement*, because it is in these foul places that the Calcutta epidemics have their origin. Without drainage and water the only remedy against this bustee property was simply clearance of the site, but now that the foundation has been laid many of them will no doubt admit of being improved in construction and in sanitary arrangements.

Up to the end of the official year 1883 there had been carried through the bustee districts 4,969,000 superficial feet of roads, and 19,684,000 superficial feet of ditch surfaces had been drained and converted into paths, making a total improved area of 24,653,000 feet, or 1,714 bighas of 14,400 superficial feet each, and on these facts of drainage work the chairman remarks that, "as there are "only 3,074 bighas of bustees in the whole town, many of which are very small and capable of "surface drainage, it will be easily understood what an enormous revolution in the condition of the "bustees has been silently effected by operations of the Drainage Department. Many bustees have "been so thoroughly reclaimed as to be quite unrecognisable by those who knew them in their "former condition."

There are many cases, however, in which properties have to be wholly or partially removed, and these are often difficult to deal with. The whole subject is, however, in hand, and need not be further dwelt on at present. Time and money are both necessary for the work. One of the worst blocks, Jora Bagan bustee, covering 28 bighas, it was found would cost 34,400*l.* for acquisition, and 7,100*l.* for roads and drainage.

21. But after all, the chief disease causes are distinct from the bustees, although incidental to their existence. These are the foul tanks and local difficulties in the way of cleansing. Years ago, Dr. Payne, then Officer of Health, called attention to the tanks, of which he had measurements made of 795, exposing a foul surface of 146 acres, as prominent disease causes among the bustees. Their contents were chiefly filth and sewage, and many of them were the sources of water-supply for the inhabitants. Up to the end of the official year 1883, 138 of them had been filled up, but the work is proceeding very slowly; and although "the majority of the worst class of tanks has been filled up," there had apparently been no supply of pipe-water laid on for the use of the people whose tank-water had been taken away. Steps, however, had been taken to remedy this deficiency.

22. In the matter of surface cleansing a special establishment had been appointed, "with the best results, from the commencement of 1883–84." In other respects the cleansing was being improved, and this Report for the official year 1882–83 shows increased energy in sanitary operations.

23. We cannot do better than close this review by quoting the skilled technical statement of the officer of health, who says: "New roads have been made, foul drains have been piped and converted into clean pathways, new areas have been provided with sewers, and the houses connected with these, for the removal of house and bath washings, which previously stagnated and stank. Streets have been widened, and facilities provided for the removal of refuse; tanks and wells containing water, which has been truly described as diluted sewage, have been filled up, and substantial progress made in the reclamation of some of the worst *bustees* of the town."

Public opinion had been so far educated on the subject of health improvements that public agitation on behalf of greater vigour had manifested itself on two occasions, on each of which the municipality appointed a committee, the outcome of which has been:—

"(1.) The organisation of a nuisance department.

"(2.) The organisation of an establishment for bustee conservancy.

"(3.) The assignation of more money for bustee improvement and general conservancy."

(4.) Household "rubbish, in place of being cast on the footpaths and roadways, is now retained in bins and baskets, and removed from the interior of compounds by carts.

"(5.) Accelerated effort to increase the water supply of the town."

(6.) Improvement in the sewer system.

This, of course, must include sufficient water for keeping all the drains and sewers free from deposits.

The whole case as regards future progress in the sanitary improvement of the capital of India is fully discussed in the Government Resolution on the Report under review. But the most important of all present work is cleansing and keeping clean. The extension of drainage, water-supply, and bustee and general town improvements will take time, but cleanliness is an ever-present need, which it is also possible always to comply with. Very much remains to be done, and it is in this direction that enlightened public opinion, properly expressed, may do good. Sanitary work has not the characteristics which generally ensure progress in other matters. It claims little scientific *éclat*; it has no glory, either military or civil, attached to it. It must be done solely for the public good, and the public must bear its part of the work and of its cost before it can reap the great benefits which follow in time.

24. Part of these benefits have been already reaped, and, while we are desirous of adding our voice on the side of progress more rapid than has hitherto taken place, we shall conclude the present memorandum with the following passage from Dr. McLeod's lecture already referred to, which gives a brief statement of the results to public health hitherto attained, and by doing so holds out abundant hope in the future. He says: "The time was when people met at the beginning of the cold weather, and congratulated each other on having escaped the perils of the hot weather and the rains. Malarious fevers have been all but banished from the city, the type of many diseases, dysentery, for example, has got milder, and life is more secure than it was. History tells of great plagues in former times; of a famine in 1752 that carried off large numbers; a severe epidemic in 1757; of another in 1762, which killed 50,000 natives and 800 Europeans; of a famine in 1770 that killed 76,000 souls. These terrific visitations have ceased. Sir Ranald Martin, in his work on the influence of tropical climates, gives figures showing the mortality of Calcutta for five years, 1832 to 1836. The rate was 51·7 per 1,000 of inhabitants. The present rate is 30 per mille. A difference of 20 deaths per 1,000 represents in Calcutta an annual saving of 8,664 souls. The case is stronger if we take particular diseases, such as cholera and small-pox. Dr. John Macpherson, in his work on 'Cholera in its Home,' gives the aggregate of cholera deaths in Calcutta for 26 years, ending 1860. The annual mean is 4,911 deaths. The annual mean of the years 1865 to 1869 is 4,388, and of 1870–82, the period of improved drainage and supply of pure water, 1,385. This represents a saving of 3,000 lives yearly, or 40,000 in the 13 years. The total mortality from small-pox in the decade 1873–82 was 3,600, against 6,058 in the previous decade."

The whole case is as complete as it could well be. Amid great difficulties incident to the adoption of totally new sanitary works in a climate differing materially from that of the country in which they took their origin, in the face of much ignorant opposition on theoretical grounds which have no place in sanitary proceedings, and notwithstanding great and unexpected outlay, the Calcutta authorities have persevered, not always without halting, it is true; but a glance at the results already attained ought to be the strongest inducement to perseverance until the capital of India is finally cleansed of its local disease causes.

14th August 1884.

No. 13.

Memorandum of the Army Sanitary Commission on the Administration Report of the Madras Municipality for 1882.

1. It appears from a statement made by the President of the Municipal Commission that the census figures of 1881 had not been used in this Report because the returns had been made by wards and not by villages. The figures of the previous census of 1871 had therefore been used, so that we have no accurate account of the death-rates in the different population groups which make up the city of Madras.

2. The total population given in the tabular abstracts is 397,552. There is a considerable moving population, so that the actual numbers on which the death and birth-rates should be taken are liable to variation. Our estimate of the numbers in 1881, given in our memorandum on the municipal report of that year, was 404,636; but as this number included some houseless poor, it is probable that the ratios remain very much as they were, and that the population total adopted in this year's Report is practically a reliable one, at least that it is not far from the truth.

3. The births, excluding stillborn, were as follow :—

Males	8,599	
Females	7,924	
	16,523	
Stillborn	468	
Total births	16,991	= 42·7 per 1,000 of population.

The registration of births has been improving, for the number registered in 1872 was only 8,166, considerably less than one half of the numbers reported in 1882.

4. The deaths registered in 1882 were below the average. They numbered 14,169, of which 7,108 were males and 7,061 females.

The conjoint death-rate was 35·6 per 1,000, against 38·9 per 1,000 in 1881, and 37·4 per 1,000 in 1880. The average number of deaths registered during the previous 10 years, but excluding the pestilential ratios of the famine time, were 14,946, so that the actual deaths registered in 1882 were 777 below the average.

5. The death-rates among different classes of the population were as follow :—

	Ratios per 1,000.
Europeans	21·3
Eurasians	27·8
Native Christians	24·0
Hindus	37·9
Mahomedans	29·8

The European death-rate is probably kept down by sending away children, and leaving Madras for change.

6. The following were the death causes in 1882 :—

Diseases.	Deaths.
Cholera	461
Small-pox	355
Measles	148
Fevers	3,706
Bowel complaints	2,110
Other diseases	7,389
All causes	14,169

The next abstract gives the deaths from each cause in the villages in Madras for the year 1882.

Villages.	Population.	Cholera.	Small-pox.	Measles.	Fevers.	Bowel Complaints.	All causes per 1,000 of Population.
Tondiarpettah	35,240	13	23	1	104	45	30·6
Washermenpattah	6,409	65	8	10	319	11	
Royapuram	11,089	89	15	8	207	39	65·1
Cashmode	12,383	31	3	11	180	49	32·4
Poddoo Naicks Pettah	65,629	34	45	34	697	335	40·1
Big Parchewy	2,179	—	—	—	—	—	—
John Pereira's Garden	2,930	—	—	—	—	—	—
Moothealpettah	32,062	57	40	13	405	213	34·4
Uttapaulium	18,395	—	—	—	—	—	
Fort St. George	1,588	—	—	—	—	1	3·1
Gunpowder Mills	641	1	1	—	10	4	21·8
Perambore	5,650	5	23	5	70	44	48·8
Viasarapaudy	3,390	3	—	—	19	11	16·8
Choolay	15,000	1	75	7	123	89	37·3
Pursewalkum	19,006	8	33	8	178	130	36·3
Purcaimettoo	14,275	2	4	3	62	37	24·2
New Town		7	—	—	4	10	
Vepery	4,500	3	2	—	14	7	16·4
Poodoopettah	3,774	1	2	1	32	21	33·3
Egmore	4,392	3	5	1	45	30	22·6
Comaleeswarapuram	7,544	1	1	3	37	15	
Kilpaukum	5,222	—	3	—	15	24	19·5
Chetput	2,611	—	—	1	15	18	27·9
Nungumbaukum	7,704	7	3	4	40	37	19·4
Mackey's Garden	3,858	1	—	—	19	14	17·1
Poodoopaukkum	6,025	3	—	2	76	39	42·8
Chintradipettah	15,120	12	4	5	137	88	36·5
Narasingapuram	3,046	1	—	2	31	21	34·7
Triplicane	33,258	22	27	18	349	168	40·7
Theroovatteeswarampettah	12,057	6	6	2	50	25	15·1
Saint Thomé	20,575	6	5	3	209	104	32·2
Alwarpettah	1,168	—	2	—	22	13	
Boyapettah	5,256	6	5	1	65	52	42·8
Meersathpettah	2,050	1	1	1	46	18	64·3
Kistnampettah	5,193	—	—	—	41	33	28·4
Thanampettah	7,248	—	12	3	44	24	21·3

7. This abstract shows which are the epidemic points in Madras, or rather the villages in which epidemics prevailed most severely in 1882, and the facts may be taken as in some sense showing where sanitary work is most required. This conclusion is not invalidated by the fact that 804 deaths out of the year's mortality took place in the hospitals, because most of these would be due to diseases arising in the villages which supplied the cases.

8. The present Report, although entering fully into the disease statistics of 1882, gives no information regarding the sanitary state of the villages, or on the conditions affecting the public health. We must, therefore, endeavour to carry back the disease history in order to ascertain the relation of the epidemic facts of 1882 to those of preceding years, and perhaps the best way to do this will be to include in one abstract the deaths from all causes and from cholera and fevers for the following years:—

Years.	Deaths from Cholera.	Deaths from Fevers.	Deaths per 1,000 of Population. All causes.
1870	861	2,296	29·9
1871	493	2,474	32·7
1872	5	2,843	35·2
1873	6	2,569	36·7
1874	—	2,679	36·8
1875	225	2,843	35·5
1876	2,105	2,351	39·6
1877	3,025	6,407	99·9
1878	85	4,982	47·5
1879	35	3,465	34·7
1880	2	3,549	37·4
1881	126	3,698	38·9
1882	461	3,706	35·6

The great mortality of 1877–78 was due to two causes, first, the influx of an unknown number of famine-stricken people, and second, calculating the death-rate on the only approximately known population element, namely the residents. These two years are quite exceptional, but if we leave them out we still have very high death-rates from all causes, especially from fevers, and an increasing loss from diseases of the febrile group. In all the elements of progress the statistics are more unfavourable in Madras than they are in the other two capital cities.

9. The next abstract shows the monthly incidence of deaths from assigned causes in 1882.

Months.	Cholera.	Small-pox.	Measles.	Fevers.	Diarrhœa and Dysentery.	Other Diseases.	Total Deaths.
January - - -	160	14	21	367	254	597	1,413
February - - -	203	34	23	339	229	509	1,337
March - - -	74	62	17	287	141	582	1,163
April - - -	20	56	16	251	120	554	1,017
May - - -	4	32	20	268	151	590	1,066
June - - -	—	27	15	287	123	565	1,018
July - - -	—	30	5	288	160	612	1,095
August - - -	—	20	6	359	236	657	1,258
September - - -	—	50	4	346	184	623	1,187
October - - -	—	21	8	285	179	665	1,158
November - - -	—	18	5	279	150	684	1,131
December - - -	—	15	8	369	183	751	1,326

The cholera mortality in this table shows apparently the passing over of an epidemic outbreak from the previous year. In a preceding abstract we have shown the incidence of cholera among the population groups, and that 27 of these groups out of 36 yielded cholera deaths. The previous year's cholera deaths, which were 126 in number, all took place in 12 population groups towards the end of the year, and then, as now, the Madras Report gave no information on the local causes. These 126 deaths were made up of 1 in September, 2 in October, 40 in November, and 83 in December.

The President of the Municipal Commission makes the remark that this cholera epidemic of 1881–82 "fell most heavily on those parts of the town that were dependent on wells for their water-"supply, and were beyond the distribution of the Red Hill water pipes; 333 deaths, or 57 per cent., "occurred in these localities, namely, Royapooram and to the north of it, and St. Thomé, with a "population of 86,000, or one-fifth of the whole of Madras, while 254 deaths occurred in the rest of "the city, with a population of 320,000."

This observation is a very important one, resting as it does on statistical fact and not on opinion, and it points not only to the effect of foul drinking water in aggravating epidemics of cholera when they happen to be in a district, but to the predisposing influence of subsoil conditions, with or without the foul water addition. Cholera prevailed where the drinking water was comparatively pure, but not to the same extent as where the influence of foul water was added to the influence of foul subsoil. In this region the death-rate from cholera was nearly fivefold what it was in the purer water districts, but still cholera was there, and we have referred to some evidence supplied by cholera among convicts in our memorandum on the Sanitary Commissioners' Report on Madras Presidency for 1882, which leads us back to the unwholesome subsoil conditions of this city to which we have often referred in previous memoranda.

It is unnecessary to dwell further on the disease history of the year. We can only express the regret that the Madras Report has not been arranged like those for the other cities, which not only give a good general idea of the year's disease causes, but point to the remedies at the same time.

10. *Sanitary measures.*—By far the most satisfactory part of the year's work comes under the designation of conservancy. The amount spent on this important sanitary measure was 24,669*l.*, and 1,219 coolies, 621 carts, and 5 canal barges were employed in the removal of 404,000 cartloads of rubbish and filth, besides 10,530 tons of night-soil. Part of the sewage is applied to seven sewage farms, of which the receipts and expenses are given for six. Three of these yielded a profit in working of about Rs. 1,500, and three others a loss of Rs. 2,100. The remaining one appears to ave been only commenced by an outlay of Rs. 241.

11. *Water-supply.*—The Red Hill works appear to be still in an unsatisfactory state. "Fish ten inches long have been found jammed up in two-inch pipes." It is quite truly said by the president that this state of matters must continue until filtration is introduced. In the course of the year a loan of 25,000*l.* was contracted for extending the present water-supply by pipes, and in three of the city divisions "17 miles of pipes were laid, varying from one to six inches in diameter, 124 valves, and 211 hydrants were fixed, and 133 fountains were erected," besides one in front of the General Hospital. All this is a real advance on the past state of matters, but it is to be regretted that some of the worst epidemic localities cannot yet be brought under this improvement. We have little doubt, however, that good results to the public health will follow this water expenditure.

12. We have so often discussed the sewage principles which have been adopted for Madras, that it is unnecessary to enter further on the subject. We can only wait the results, and express a sincere wish that they may be better than we have been led to anticipate from similar works in other Indian towns. Among drainage works still in progress was diversion of sewage from the Cooum and canal. The necessary intercepting sewers had been laid, and a pumping engine and well were in course of completion.

13. Since the date of the Report under review Madras has been visited by a severe epidemic of small-pox, and the only fact bearing on this matter is, that in 1882 the vaccinations under one year of age were 8,968, or about half the children born. It is evident that increased activity in this branch of sanitary work is needed.

14. In conclusion, the present Report, although containing very full statistics of village death-rates and their causes, is deficient in sanitary details, so that the relation of deaths to local causes has rather to be guessed at than proved. The all-important conservancy work appears to be increasing in extent and efficiency, and in the present state of the subsoil this means of disease prevention has mainly to be relied on for protecting the public health.

An important extension has been given to the existing water-supply, which we hope will have a beneficial effect on the health of the villages where it has been introduced. But it seems to be a corollary to this work that the bad wells should be filled up.

One of the most important drainage measures has been the diversion of sewage from the Cooum and canal.

Lastly. It is evident that the vaccination service requires extension, so as to cover the births, and, even when this is done, it will take years to reduce small-pox mortality to its lowest attainable point.

3rd September 1884.

No. 14.

MEMORANDUM of the ARMY SANITARY COMMISSION on the ADMINISTRATION REPORT of the MUNICIPAL COMMISSIONER of BOMBAY for 1882.

1. The population of Bombay, according to the census of 1881, was 773,196. The births were, of—

Males	-	7,945
Females	-	7,421
Total	-	15,366 = 19·87 per 1,000 of the population.

The deaths in 1882 were, of—

Males	- 10,861
Females	- 9,607

The male death-rate was 23·36 per 1,000, and the female death-rate 31·14 per 1,000.

The total deaths were 20,468, or 25·89 per 1,000, calculated on the census population, *plus* a year's increment.

It seems likely from these facts that registration of births is still defective, otherwise we should have to accept them as showing that the population of Bombay is kept up by immigration. There is, of course, the usual difficulty which shows itself, in the case of seaport towns, that there is a large shifting population both by land and water. Whatever be the explanation, the birth-rate cannot be accepted as correct.

2. The following abstract gives the population and death-rates according to classes:—

Classes.	Population, 1881.	Deaths per 1,000.
Jains -	17,218	53·08
Brahmins -	35,423	21·02
Lingaets -	1,167	35·13
Bhatias -	9,417	29·62
Hindus of other castes	407,717	24·99
Hindu low castes -	49,122	32·14
Mussulmans -	158,024	29·87
Parsees -	48,587	18·48
Jews -	3,321	24·08
Native Christians -	30,708	23·05
Eurasians -	1,168	31·67
Europeans -	10,451	17·70
Negro Africans -	689	194·81
Chinese -	169	11·83
Others -	—	?

3. There is a difficulty in estimating the death-rates of Bombay for a series of years on account of the population element, which is not easily arrived at; but the following registered mortality for the

last six years shows that, with a rapidly increasing population, the annual deaths registered have been undergoing a continuous reduction:—

Years.	Total Deaths in the City.
1877	33,511
1878	26,999
1879	22,527
1880	21,146
1881	21,856
1882	20,468

4. The next abstract gives the deaths and death-rates arranged under their assigned causes on the calculated population of 1882.

Causes of Death.	Number of Deaths.	Deaths per 1,000 of Population.
Small-pox	92	0·11
Measles	991	1·26
Fevers	5,453	6·90
Cholera	192	0·24
Phthisis	2,729	3·45
Nervous system	2,557	3·24
Respiratory diseases	3,402	4·30
Diarrhœa	1,093	1·38
Dysentery	525	0·66
Accidents	346	0·44
All other causes except still-born	3,088	3·91
Total	20,468	25·89

5. As usually happens, the total death-rates and the rates from particular diseases vary considerably in different districts of the city, and, perhaps, the best general idea of the sanitary condition of Bombay in 1882 will be found in placing the ratios for each district under one view, including the rates from epidemic diseases, together with the general death-rate.

Localities.	Population, 1881.	Death-rates per 1,000, 1882.				
		Cholera.	Small-pox.	Fevers.	Measles.	All Causes.
Colaba, Upper	2,867	1·04	—	5·58	—	27·90
Colaba, Middle	14,265	·49	—	5·53	1·33	18·78
Colaba, Lower						
Fort, Southern	3,515	—	—	1·13	—	8·98
Fort, Northern	33,828	·15	·95	6·26	0·59	22·76
Esplanade	13,080	·61	—	6·26	0·15	17·35
Market	49,130	·18	·46	5·25	2·20	23·26
Mandvee	42,851	·35	·04	8·78	1·79	32·63
Chuckla	37,048	·10	·10	6·34	1·07	29·90
Oombarkatee	54,656	·12	·31	7·83	2·08	38·24
Dongree	33,290	·09	·27	7·59	3·21	27·36
Dhobee Talao	39,409	·15	·17	8·27	1·35	29·35
Phuauswaree	23,218	·47	—	4·22	1·37	19·16
Bhooleshwur	38,106	·18	·07	5·85	0·99	28·44
Khára Talao	28,691	·10	·03	7·66	1·42	33·11
Khoombharwarra	34,990	·40	·08	7·88	1·34	27·29
Khetwarry	29,486	·10	—	5·87	0·87	21·87
Girgaum	25,819	·78	—	5·48	1·93	26·18
Chaopatee	10,975	1·00	—	5·46	0·54	20·13
Walkeshwur	11,868	·08	—	3·89	0·44	15·57
Mahaluxmee	6,232	·16	—	7·86	0·32	20·53
Mazagon	27,904	·14	·10	7·38	1·14	24·69
Parwaree	14,542	·13	—	6·80	1·51	30·60
2nd Naghada	15,922	·06	·31	7·09	1·19	37·05
Kamatheepoora	28,465	·21	·14	9·52	1·58	38·76
Tardeo	20,281	·19	—	7·10	0·98	20·85
Byculla	26,842	·11	·07	7·56	1·22	26·41
1st Naghada	9,372	—	·53	8·32	3·52	34·67
Parell	18,560	·64	—	12·71	1·50	32·38
Sewree	5,556	·54	—	8·10	0·54	22·32
Sco	17,237	·11	·05	8·35	0·23	21·81
Mahim	17,309	—	—	9·59	0·17	22·47
Worlee	14,621	—	—	9·37	0·13	19·62
Water division	24,887	·60	—	1·36	—	3·41

6. These tabular statements give the year's sanitary history in sufficient detail for practical consideration, and the first point which attracts attention is the insignificant death-rate from cholera, and yet, on account of this one disease, the European Powers keep up a costly and, so far as

commerce is concerned, a vexatious quarantine establishment. By the same process of reasoning, through which the contagiousness of cholera is believed in, there are many who hold the contagiousness of phthisis, and the prevailing view is that both possess a particulate contagion of the same genus of fungi. Now, the mortality from phthisis in Bombay in 1882 was 14 times the mortality from cholera, and the mortality from fever 28 times the mortality from cholera. Even measles yielded fivefold the mortality of cholera, yet cholera is the only one against which quarantine is considered necessary. It seems impossible to escape the conclusion that reasoning on the quarantine hypothesis demands the stoppage of all intercourse between Bombay and the West. This much on the general subject, and although, in the present state of public intelligence on health questions, no one would dare to apply the results in actual practice, it is necessary to re-state the facts by way of caution, and to show in what direction the real logic of them would carry us.

7. The amount of cholera in Bombay in 1882 was not so great at any one time as to call for much discussion, but the following statement by the Officer of Health may be quoted as indicating generally the local sanitary state of affected localities: "The conditions amidst which groups of cases arose, "were generally those conditions observed surrounding outbreaks of 1881; there has been a distinct "intensity manifested in particular districts and around particular centres of population, but the "incidence of the mortality from cholera and of the total mortality have not fallen uniformly and "with uniform severity throughout the districts of the city; sections of the highest total mortality "are not sections of the highest cholera mortality. The chief predisposing influence appeared to be "of an individual constitutional nature, so to speak. The most general conditions I observed "surrounding the groups of cholera cases were, as in 1881, shortly, dampness, dampness of ground, "of walls, imperfect ventilation and resulting air impurities; the exciting agencies of greatest "potency, inasmuch as of most frequent occurrence, appeared to be dampness, humidity, which "implies soil saturation, and pollution, arising from imperfect channels for removal of sewage, "sewage stagnation and soil saturation and pollution being in the relation of cause and effect, air "impurity and darkness arising from defective ventilation and lighting, dwelling and surface "crowding."

8. We have here the local conditions described which specially characterise epidemic localities, and there is a fact stated about the incidence of cholera in Bombay which appears to show clearly the dangers of coming fresh into such places, for it appears that out of 236 cases and 192 deaths from cholera in 1882, only 21 cases and 17 deaths took place among persons born in Bombay; all the rest, with the exception of three cases and two deaths not traced, occurred among immigrants.

9. In former years we have quoted the facts regarding relation of cholera to water sources as a contribution to the disputed question of the causative effect of bad water on cholera mortality, which last is still a favoured theory with some people. We shall again quote the experience of 1882.

—	Cholera Cases.	Deaths.
Vehar or Tulsi water consumers	165	135
Well water consumers	37	32
Not known consumers	34	25

These facts give the history of cholera in 1882, in relation to the water sources. And it will be seen that the weight of the epidemic of 1882 did not fall on those who used the sewage-polluted wells, but on the population supplied with water brought from country gathering grounds by pipes. The quality of the pipe water is not all that could be desired, or that it will be when the works are completed, but it is greatly improved over the old well supply. The real reason of the higher cholera rates with the outside water-supply is its extension to epidemic localities which yielded by themselves, and apart from the water, the higher cholera rates.

10. The sanitary precautions adopted during the cholera of 1882 aimed at "cleanliness in the "widest sense, so far as practicabilities, the more cleanliness, the more perfect prevention, experience "in combating disease in this city indicates."

Facilities for constant cleanliness, and keeping clean, are the ends aimed at by all sanitary engineering works, and the benefits of the public health already obtained in Bombay may be estimated in some measure from the fact that 1882 was a great epidemic year in India, during which 347,932 people died of cholera. Of these 7,904 died in Bombay Presidency in scattered villages over a great extent of country. The Presidency death-rate was 0·48 per 1,000, whilst the city death-rate among an overcrowded population of 773,196 was 0·24 per 1,000, or just one-half the Presidency rate, and, as we have already shown, the total deaths from cholera among known Bombay people were only 17 out of 192, the remainder, so far as is known, having been among immigrants. We shall conclude this notice of cholera with the following monthly deaths in 1882:—

Months.	Cholera Deaths.	Months.	Cholera Deaths.
January	82	July	12
February	52	August	12
March	17	September	6
April	5	October	2
May	1	November	—
June	—	December	1

The cholera history of Bombay is very different now from what it was in old times, when its deaths were numbered by thousands, as we have shown in other memoranda.

11. *Fevers.*—These were the most important death causes in 1882, and it may be useful to extract the year's registered fever deaths arranged according to the nomenclature of the Royal College of Physicians, for in this way we shall obtain a better account of the causes:—

Fevers.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total Deaths.
Enteric	—	3	2	1	1	1	3	—	6	1	2	2	22
Relapsing	—	—	—	—	—	—	1	—	—	—	—	—	1
Simple continued	58	58	73	65	94	79	59	94	105	80	75	87	927
Ague	30	19	18	14	13	10	26	18	22	25	21	27	243
Ague, with bronchitis	2	1	1	—	—	—	—	—	—	—	—	—	4
Ague, quotidian	7	1	5	22	11	3	—	6	2	7	2	1	67
Ague, tertian	—	—	—	2	—	—	—	—	—	—	—	—	2
Remittent	454	425	473	305	309	248	267	305	332	358	328	291	4,095
Remittent, with bronchitis	10	3	1	1	1	2	—	1	2	5	3	6	35
Remittent, broncho-pneumonia	—	—	—	—	—	—	1	—	—	—	—	—	1
Remittent, convulsions	—	2	—	—	—	—	—	—	—	—	—	—	2
Remittent, diarrhœa	24	5	3	—	—	—	—	—	—	4	—	2	38
Remittent, dysentery	2	—	1	—	—	—	—	—	—	—	—	1	3
Remittent, jaundice	1	—	1	—	1	—	—	—	1	—	—	—	4
Remittent, pneumonia	—	1	3	—	2	1	—	—	2	—	—	1	10
Cerebro-spinal fever	—	—	—	—	1	—	—	—	—	—	—	—	1
Total monthly fever deaths	587	518	581	476	433	344	357	424	472	480	431	418	5,455

Arranged in this manner, with their fatal complications, we see at once that ordinary malarious fevers are not frequent as death causes in Bombay. The whole ague tribe, with their complications, gave rise to only 316 deaths, or under 6 per cent. of the total fever mortality. The deadly fevers were remittents and continued fevers, which gave rise to 94 per cent. of the fever mortality. There were only 22 deaths attributed to enteric fever, one to relapsing, and one to cerebro-spinal fever.

Sanitary work has thus to deal not so much with the ordinary malarial fever causes, but with that class of causes which in tropical cities and towns give rise to fatal continued and remittent fevers, and these are all more or less co-existent everywhere with putrescence. It follows that the general improvements in drainage, water-supply, cleansing, paving, and house improvements now in progress will afford the best security against fevers in Bombay, as in other cities. There is evidence of progress in these matters in the statistics, which show that ever since 1848 there have been very few years, only six, in which the registered fever death-rate has been a shade lower than in 1882. In all the others it has been considerably higher, and in certain years the deaths have been those of pestilences, as for instance in 1864-65, when 31,360 people died, and the famine year, 1877, when the fever deaths amounted to 12,832. The statistics, as a whole, show the presence of what may be called a certain fever tension ready to pass its bounds on occasion, and the result is, as already stated, that sanitary work should be vigorously pressed forwards. This view is further sustained by the facts shown in the preceding table, that fever death-rates in Bombay are not subject to climatic influence as they are elsewhere, proving in another way that their causes are more or less purely local, as is also shown by the diversity of rates in different localities of Bombay given in a preceding table.

12. We may go a little further, and cite a case or two of local fever outbreaks. One of these was in an educational institution in an open situation where enteric fever broke out.

It had no house drainage, and the sewage could not be properly dealt with for want of it. "In "the privies," we are told, "in this institution there was not the great safety against putrid organic "exhalation which exists in privies in the town, which is this, place for reception of fæcal matter "exposed to light and air, but there was sufficient ventilation to excite changes not sufficient to "destroy the products of change." Of course the only comment that can be made on such a state of matters is, that there ought to be no sewage there at all, and that it is the duty of the municipality to provide for its immediate removal by drainage and water. Take another example, where relapsing fever cases took place among poor Mecca pilgrims in a "chall," now removed on account of its unhealthiness. The Officer of Health reports of it as follows:—"Ground on three sides a swamp, "to enter rooms on ground floor must wade through swamp, rooms on ground floor had each a "separate door giving a separate entrance and opening on to the swamp." This brief note tells us the state of the subsoil and the cause of the fever in half-starved people.

Fever mortality yielded a death-rate of 6·46 per 1,000 males, and 7·93 per 1,000 females. The most fatal ages for fevers are those under three years and above 50 years of age, when the death-rates taken on the population of these ages are the highest. The rates to population are all very much lower for the intervening ages, but inasmuch as these ages include the great mass of the population, fever death-rates as usual tell most severely on the productive ages, and tend directly to impoverish the people.

As regards locality, it has been shown in a preceding table that fever death-rates vary greatly in different parts of the city, between 1·13 per 1,000 in Fort Southern and 12·71 per 1,000 in Parell; there must be causes to yield such diverse rates.

13. *Small-pox.*—The last epidemic outbreak of small-pox in Bombay took place in the year 1876, when 3,174 deaths from this cause were registered. Since this event the deaths have been as follow:—

Years.	Small-pox Deaths.
1877	958
1878	357
1879	479
1880	207
1881	35
1882	92

The deaths in 1881 were the fewest recorded in any single year. Bombay has an active vaccination service, and calf lymph has been in use. As we have already seen, the year's births amounted to 15,366, a number below the truth apparently. The vaccination work of the same year stood as follows:—

	Successful Vaccinations.
Under one year	12,619
Under six years	3,837
Above six years	587
Total successful	17,043

These data show a great amount of good vaccination work done at the younger ages, when it is most useful. Besides these primary operations there were 973 successful re-vaccinations, raising the total successful cases to 18,016. These facts are sufficient to give a general idea of the year's disease history, and we shall next say a few words on the sanitary work done.

14. *Sewerage and Drainage.*—The works in progress during the official year 1882–83 were the first portion of the new sewerage works, including the new main sewer from Love Grove pumping station to Carnac Bunder, the outfall sewer at Worlee, laying of pipe sewers, the pumping station at Love Grove; and of details of work, the Queen's Road intercepting sewer, sewerage of Kamatheepoora, and the surface draining scheme. The works appear to have made considerable progress during the year, and there are some points of experience which have been obtained from their execution that throw light on local disease causes. The following quotation from the Engineer's report shows the effect of laying drains on the subsoil water level:—

"It may be incidentally observed that the laying of the pipe sewers in connexion with the main sewer has had a very marked effect in lowering the subsoil water of the districts through which they pass. Where pipes were laid under the greatest difficulty, owing to the large quantity of water, the ground on subsequent re-opening has been found comparatively dry. The subsoil water was undoubtedly in numerous places confined in pot holes or depressions in impervious trap, and, the rims of these depressions having been cut through for the pipes, a creep of water has taken place along the filling of the trenches, all of which have a fall to the main sewer, which itself has, of course, a fall throughout its entire length."

This passage points to a not uncommon fever cause in India and at military stations, and it also describes the remedy, which in the present case was applied without any cost to the rates in the process of ordinary pipe drainage. In draining houses the same results are obtained. Sewage is removed and subsoil water at the same time, and the subsoil is dried and purified.

15. The other case is even a more remarkable example of how neglect of house drainage fouls the whole subsoil. It is the case of Kamatheepoora, which had a death-rate of 38·76 per 1,000 in 1882. Attempts had been formerly made to drain this district, but the works were defective, and it was resolved to redrain it, and the following experience was obtained.

All the trunk sewers having been finished, the laying of house branches was commenced in the sweepers' passages.

"The work was foul to the last degree, the walls of the houses on either side being besmeared with night-soil, and filth of all kinds" trickled down the walls on to the paving, "dirty and greasy "water coursing down the wall from holes communicating with nahanis and cookhouses, and the "soil saturated with sewage from defects in the paving and the work of rats about it. So disgusting "was the work to be done that the contractors found the greatest difficulty in obtaining workmen "to do it." The difficulties were so great, partly from the construction of the houses, that the contractors were ordered to excavate only four feet, and in some cases only two feet at a time, and to lay the pipes and fill in the excavation as the work proceeded. Unfortunately, the new house fittings could not be put up in connexion with the new drainage, so that matters remained much in the same state. One house, however, had the new privies put up and connected with the drains.

"The privies act exceedingly well, and are so much approved that the people in large numbers from the surrounding neighbourhood use them in preference to their own." They are trapped and supplied with water, and "the occupiers of the houses state that they never perceive any smell." The municipal stables and others have been connected with the drains, "and are in perfect action."

It is to be hoped, with this experience before them of the neglect of drainage in times past and its results to the public health, and also of the applied remedy, we shall hear no more of the inapplicability of Western engineering works to Eastern habits of life.

16. There is a surface drainage scheme under contract for relieving the sewers of excessive rainfall, and one part of it appears to be the formation of a storm-water reservoir, having an area of 176 acres. We can say nothing about this proposed work except to suggest that there should be as little evaporating margin in the dry weather as possible. An area of 176 acres of clean rain water would be of no injury to air purity. It would be otherwise if the water were mixed with sewage, but positive injury to health might result if a large area of impure water, or of the bed it covers, were left to evaporate under the sun after the bulk of it had been drawn off by the drains.

On the whole, it is very satisfactory to observe that, before long, Bombay will have its house drainage in the way of execution.

17. *Water-supply.*—The rainfall over the Vehar and Tulsi gathering grounds was considerably below the average in 1882, as is shown in the following table :—

Years.	Vehar.	Tulsi.
	Inches.	Inches.
1879	76·42	99·62
1880	72·42	98·76
1881	59·10	86·14
1882	54·63	74·22

There is a cycle of diminished rainfall in progress, and as a natural consequence the residual lake water increases in impurity. This has been especially the case with the Tulsi water, and was formerly the case with Vehar water. Time and increase of rain will diminish the impurity, but, as this is mainly of vegetable origin, it is more disagreeable than injurious. The great remedy, however, is filtration at the point where the supply is passed for distribution into the pipes. The present sources of public supply are 46 dipping wells, the worst of all methods, 54 drinking fountains, 24 stand pipes, 13 large ornamental fountains, 12 cattle troughs, and 13,244 house connexions. This last method of supply is making steady progress. There are 737 water meters in use.

There were 4,241 notices of leaks served and repairs to be executed. Mains and house services were inspected by the waste prevention establishment, which since it began operations had discovered a waste of 437,000 gallons of water per diem.

The Malabar hill reservoir works were still under construction.

It may be stated, in connexion with the water supply of Bombay, that the Parsee community have erected a large ornamental drinking fountain to commemorate the late Mr. Bomanjee Hormarjee, one of their heads. It is in the ancient Persian style of architecture, 2,500 years old, and the cuneiform writings on it have been selected from copies of a rock inscription in Behistun of the same period. The work was done by the engineer, Mr. Walton.

18. During the year under review the Conservancy Department has been actively engaged in cleansing operations. The average cleansing staff consisted of 2,643 men and women. There were 463 scavenging and drain-cleaning carts, and 103 night-soil and cesspool carts in daily use. By this agency 141,611 tons of garbage were removed in the course of the year, against 136,867 in 1881, and the daily removal of night-soil was 2622 tons, against 2336 tons in 1881.

Cleaning out of covered drains is still necessarily carried on, and 205¼ miles were dealt with in this way in 1882.

19. These are the chief points in the present Report which appear worthy of note. There has been no great public work done, but what is more to the purpose, there appears to have been steady progress made in useful sanitary detail, especially in cleansing, which is the great element to depend on for warding off the invasion of epidemic diseases. This can always be done, more or less completely, by hand labour, until the completion of house and street drainage in connexion with the water-supply enables the house sewage to be disposed of at the outlet.

6th September 1884.

No. 15.

MEMORANDUM of the ARMY SANITARY COMMISSION on PAPERS referring to the SANITARY CONDITION of the MADRAS EUROPEAN ARMY, and to the prevalence of ENTERIC FEVER among the TROOPS.

These papers, although not all included in the same reference, refer to the same subject, and we propose to consider them together in the following remarks:—

1. The average strength of European troops serving at Madras stations in 1882 was 10,817 non-commissioned officers and men. There were 11,546 admissions to hospital, 114 deaths, and 321 men were invalided for change or discharge.

These numbers yield the following ratios per 1,000 strength;—

	Ratios per 1,000.
Admissions	1,069·06
Deaths	10·54
Invalided	29·67
Daily sick	64·25

Admission and death-rates were under those of the preceding year. The daily sick and invaliding rates were a shade higher. When the rates are compared with those of the previous ten years they yield the following differences:—

	Ratio per 1,000.	
	1872–81.	1882.
Admissions	1,225·63	1,069·06
Deaths	15·63	10·54
Invalids	41·13	29·67

These figures show a considerable improvement in the sanitary state of the Madras army during the year 1882, and if it continues without material increase of sickness in subsequent years, the statement made by the Surgeon-General, "That it may be safely said, therefore, that the constant "attention which has for years been devoted to the sanitation of military buildings and to everything "likely to improve the health of the European force in this command has been productive of good "results," will become an established truth. That there is evidence of much improvement in the statistical facts may be safely admitted, but Madras is subject to sudden increase of epidemics, which also affect the troops; and while admitting the evidence of improvement, it is better to take it simply as an instalment of what may yet be accomplished by the complete application of sanitary principles and methods of procedure at the stations and in their vicinity.

2. We shall next give a brief account of the chief diseases of the year, beginning with the most fatal of them, enteric fever, from which there were 47 admissions and 23 deaths.

The following table given in Surgeon-General Madden's Report shows the stations at which enteric fever prevailed in 1882. We have added the strengths from Dr. Stephens' tables:—

Stations.	Strength.	Enteric Fever.	
		Cases.	Deaths.
Madras	739	2	2
St. Thomas' Mount	380	3	2
Cannanore	716	1	—
Calicut	101	1	—
Bangalore	1,717	19	7
Bellary	952	6	2
Wellington	556	3	2
Secunderabad	2,558	8	6
Kamptee	866	1	1
Rangoon	705	2	—
Thyetmyo	688	1	1
Total	9,978	47	23

The ratio of attacks for all the stations which yielded cases was a shade over 4·7 per 1,000, and of deaths 2·3 per 1,000.

3. This table shows a very general distribution of enteric fever throughout the command, although the actual death-rate was highest at Bangalore.

4. The next abstract shows the relation of enteric fever to age of troops.

Ages.	Cases.	Deaths.	Ratio of Admissions per 1,000 of Men of ages specified.
Under 20	3	3	11·40
20 to 24	34	15	8·52
25 to 29	10	5	2·84

The predisposing influence of young ages is clearly shown in this table. At 25 and above there is little risk from enteric fever. The chief danger is past by that time.

5. The influence of service years on the amount of fever was as follows:—

Service in India.	Admissions.	Deaths.
Under 1 year	15	5
1 to 2	11	9
2 to 3	7	3
3 to 4	6	3
4 to 5	3	2
5 to 6	4	0
8 to 9	1	1

These two abstracts merely repeat the well-known fact that young ages and early years of service determine the liability of the European army in India to attacks of this fatal fever.

A singular exception to the rule holds in the case of women and children, who suffer little from this disease. There were 851 soldiers' wives and 1,466 children at the stations. There were two cases of enteric fever among women and three among children, but none of them died. The liability of different classes is shown as follows:—

	Officers.	Non-Commissioned Officers and Men.	Women.	Children.
Enteric fever admissions per 1,000 strength	12·74	4·34	2·35	2·04
Ditto deaths per 1,000	3·18	2·12	—	—

6. In following up the history of enteric fever, we shall in the next abstract show its relation to the general fever history of Madras for a period of ten years preceding 1882, and its annual prevalence during the same years.

Years.	Strength.	All Fevers.		Enteric Fever.	
		Cases.	Deaths.	Cases.	Deaths.
1872	11,511	2,980	34	79	26
1873	11,508	2,672	17	52	10
1874	11,578	2,108	12	34	12
1875	11,233	2,177	11	23	7
1876	11,139	2,176	26	55	23
1877	11,016	2,279	24	65	22
1878	10,880	3,708	25	7	5
1879	10,507	4,175	24	12	10
1880	10,280	4,682	16	25	11
1881	10,389	2,905	8	2	5
Total 10 years		29,812	197	357	129
1882	10,817	1,928	26	47	28

This table shows that the proportion of enteric fever to all fevers, and also its annual ratio of prevalence have varied greatly in different years, and that both are independent of the actual amount of fever in individual years. In one or two of the years the relations of fever types to each other were disturbed by discussions on the nature of enteric fever, but if we admit the accuracy of the diagnosis in all these years, they go to show the independent existence of enteric fever, although it does not follow from this view that many enteric fever cases did not present themselves in the first instance as cases of ordinary climatic fever, or that cases of ordinary climatic fever did not end fatally and yield the *post-mortem* appearances of enteric fever. The eleven years given in the table

show that out of 31,740 fever admissions, 404 were at one period or other of their course diagnosed as enteric fever, or a little over 1·2 per cent. of the whole. The death-ratios, however, had a very different relation; all fevers yielded 223 deaths, but of this number 152 presented the *post-mortem* appearances of enteric fever, or above 68 per cent. of the whole.

The extent of fever prevalence differs in different years, and there are years in the table during which fevers prevailed epidemically, but it was not during these fever epidemic years that enteric fever was of most frequent occurrence. The year 1882 presented the lowest fever admission-rate on record, but with a single exception, this year was the most fatal enteric fever year of the whole series. The number of attacks and deaths was too small to admit of collation with the year's climatic data.

7. There is nothing new in the Report bearing on the question of local causes, but some long-known defects in sanitary condition reappear in it and may be noticed. For example, as has been already shown, Bangalore, out of a strength of 1,717, yielded 19 cases and 7 deaths from enteric fever, and the following remarks on the water-supply are made by the Deputy Surgeon-General:—"The nature of the water-supply at Bangalore might possibly account for the existence of the "disease at that station, were it not that all the troops drink the same water, and but few "comparatively are attacked." This is true, but it applies to all common disease causes. Natural temperament and predisposition enter into the chain of events as well as what are called "causes." Again, "although the native population and troops also derive their water-supply from the same source, enteric fever amongst them is not a frequent disease." But this fact may be nothing more than an illustration in point, for the comparative exemption from this fever of the native population is known to exist all over India. On the subject of climate the Deputy Surgeon-General says "that enteric fever may be modified somewhat by climate is not unlikely, but that it is in any "way of climatic origin there is, to my mind, no proof whatever. I cannot but think that the spread "of the disease is due to articles of food or drink obtained in the native bazaars, or perhaps the "milk brought to the barracks, which has been diluted with water from some contaminated source."

Here again we are meet with the same difficulty, that while all are exposed to the same risks in bazaars, only very few suffer; and as regards milk, the women and children, who are the milk-drinkers, suffer least from enteric fever. All this only shows how difficult a study etiology is, and how little any general assumption or presumed specific cause has helped us hitherto in unravelling the web.

8. Secunderabad yielded eight cases of enteric fever and six deaths out of 2,558 men. On this outbreak the deputy surgeon-general states that "nothing satisfactory could be discovered "regarding the origin of the disease in any of the cases that occurred among the European troops, "but, from the care and attention bestowed on all the sanitary matters affecting the health of the "force, and the absence of any insanitary surroundings in the barracks or their vicinity, it is probable "that the germs of the disease are imbibed by the soldier in the foul air or foul water of an Indian "bazaar."

One of the fundamental principles of station improvement in India is that this includes not only barracks, but bazaars and villages or towns near the station. It is not necessary to seek for special disease germs in these places. What is really wanted is, that the sanitary problem should always be taken to include not only the places where the soldier lives, but the places to which he resorts. It is impossible to predict which man may imbibe the elements of disease in the foul air or foul water of a bazaar, or native town or village, but experience has shown us that some will suffer, and it is hence in the interest of all that the cleansing, draining, water-supply, drinks, foods, &c. of these places should be looked into.

Surgeon-General Madden himself tells us, while referring to the stations, "that in no single "instance was a case of enteric fever amongst the troops traced to any special sanitary defect, "although every effort was made to discover some probable local cause." He, nevertheless, advises that unremitting attention should be paid to the current sanitary condition of the barracks, hospital, food, water, &c. But what of the bazaars and native towns? Of course, without local inspection and inquiry it would be impossible to agree or disagree with the Surgeon-General's estimate, but we have been struck by the fact that two Deputy Surgeons-General at Bangalore and Secunderabad have both called attention to the probable effects of the bazaars on the health of the troops. There is, besides, at Bangalore, the old evil of Ulsoor tank water to be got rid of; and lastly, if there be any relation of enteric fever to the general fever history of India, it can lead to but one conclusion as regards local causation, and this is that station drainage, which has yet to be done, will lessen materially the amount of malarial fever, and in doing so will diminish, in all probability, the prevalence of enteric fever.

9. *Cholera.*—There were 15 cases and 9 deaths from cholera among Madras troops in 1882, but to avoid erroneous conclusions as to the actual facts, it is necessary to go a little further, and by doing so we find that Madras stations yielded only three cases, all fatal; two at Secunderabad and one at Bellary. Of stations in Burmah, Rangoon yielded three cases and one death, and Toungoo had one case, not fatal.

Cholera was epidemic in the course of the year in the Central Provinces, and it appeared among troops marching from Kamptee to Secunderabad and Bangalore, among whom there were eight cases and five deaths. It seems probable that the predisposition was contracted in the Central Provinces, as there was very little cholera in the districts through which the troops passed, except in Berar.

10. *Venereal diseases.*—We have so frequently discussed this subject and its difficulties that little remains to be said about it, but there are one or two points mentioned by the Surgeon-General

which are of importance in the history. He says, "The incidence of venereal disease varies very "much in different parts of the Presidency and in Burmah, as may be seen from the following "table:—

	Ratio per mille of Admissions to average Strength.	
	Syphilis, Primary.	Gonorrhœa.
Eastern district - - - -	143·11	145·42
Western - - - -	74·03	62·98
Bangalore Division - - -	200·68	127·38
Hyderabad subsidiary force - -	55·10	150·73
Nagpore force - - - -	22·75	104·19
British Burmah division - - -	102·17	56·64
Depôts - - - - -	75·04	62·05
On the march - - - -	110·05	43·06

The facts in this table are similar to those which have been supplied by other districts in India, and they show that disease sources or predisposition, or probably both, exist in different degrees of intensity. On the subject as a whole the Surgeon-General makes the following remarks:—

"Lock hospitals have been for years established in all towns occupied by European troops, but "the 'Contagious Diseases Act' is never thoroughly carried out; indeed it would be impossible to "do so in such towns as Madras, Bangalore, or Secunderabad, where a large number of coolie "women can never earn more than one anna and a half, about three halfpence a day, at labour. "The soldier, as a rule, does not restrict his favours to the women who are examined periodically "under the 'Contagious Diseases Act,' and is never likely to do so, as long as there are so many "others available." And then follows this important statement, which shows that fresh sources of infection exist everywhere, whatever diligence may be bestowed in giving effect to the Acts:— "Syphilis and gonorrhœa are diseases extremely prevalent amongst the populations of the towns "of Southern India. The lower classes of natives attach little importance to gonorrhœa, and no "disgrace to those suffering from either complaint." Under such a moral condition of the people, any attempt to cover the whole sources of infection by lock hospitals would be impossible on the ground of expense, but possibly the extension of dispensary relief might to some extent mitigate the evil. Any way, the facts stated by the Surgeon-General appear to account for the failure of the lock hospital system so far as troops are concerned.

11. *Sanitary condition of stations.*—There are a few points under this head that are worthy of notice. It is evident from the statistics that much good sanitary work has been done at many of the stations, especially as regards buildings, and that there is every disposition to continue the work generally. Indeed, the matters recommended for improvement were under consideration at the time, but there are certain of them which we are desirous of sustaining from our knowledge of the facts, as well as from what is stated in the present Report.

The Surgeon-General states as follows, under the head of "drainage and sewerage and general "sanitary condition of barracks." "Though much care, labour, and money have been expended "on improving the surroundings of the barracks throughout the Presidency, still there is much to be "done in this respect. The barracks themselves, and the several buildings connected with them, "are kept in as good order as possible. The main faults are due to their situations." Some important instances of this last preposition may be quoted. Deputy Surgeon-General Murray points out that the Ulsoor barracks in Bangalore are "in very close proximity to the thickly-inhabited "suburb of Ulsoor, the sanitary arrangements of which are by no means perfect." He also considers "the drainage around the barracks at Bellary defective."

Deputy Surgeon-General Colvin Smith, C.B., calls attention to the unsatisfactory state of the ground in the vicinity of the 2nd British Infantry barracks in Secunderabad. The Adjutant-General replies to this complaint that it cannot at present be obviated, as the ground is the property of city nobles. On this subject we formerly suggested that some negotiations might possibly lead to its improvement.

12. *Ulsoor tank water.*—The only remark which appears to be called for, arises naturally out of the following statement of facts by the Deputy-Surgeon General, "in the immediate neighbourhood "of the cavalry and artillery barracks at Bangalore, where the ground is much cut up by *nullahs* "and small watercourses, which are habitually resorted to by the natives for purposes of nature, the "filthy accumulation formed during the dry weather is washed by the first heavy rain directly into "the different tanks to which they respectively lead. As the Ulsoor tank, from which the greater "part of the water for drinking and cooking purposes is derived, is subject to the like contaminations, "as well as that arising from the surface drainage from a thickly inhabited part of the cantonment "of Bangalore, it must have the effect of polluting its contents, and rendering it objectionable, if "not absolutely unwholesome." The probable effect of this fouled water on the extent to which enteric fever prevailed in 1882 has been already alluded to, and it has been shown that out of 47 cases and 23 deaths from this fever, Bangalore had yielded 19 cases and 7 deaths. We are desirous that these facts should not be forgotten until the water-supply for this important station, now under consideration, has been completed, and the Ulsoor tank supply abandoned.

13. On the water-supply generally of Madras stations, we are glad to learn from the Surgeon-General that constant attention was being devoted to the sources, and that periodical analyses were being made, with this result, that the waters were generally satisfactory as to quality, and he adds that "there can be no doubt that the periodical analyses caused stricter attention to be paid to the sources of supply."

14. *Drainage of stations.*—At Madras stations, as at all others in India, the great predisposing fever cause is the state of the subsoil, and the absence of provisions for freeing it from water immediately the rain begins to fall. In our Suggestions we have laid down the principles to be kept in view in dealing with this most important improvement, both as regards surface and subsoil drainage, and we can only add that the fever admissions in a preceding table foreshadow the fever history of British troops in Madras, and will continue to do so until the subject is taken in hand, and the stations are drained.

15. These are the leading points in the reports under review which appear to call for notice. All of them contain really practical sanitary information, given in a few words, and the general results may be summed up as follows:—

(1.) That the health of European troops in Madras Presidency has undergone considerable improvement, which may be fairly attributed, so far as present facts go, to the sanitary work already accomplished at the stations.

(2.) That this result is sufficient to justify the authorities in pressing forwards the required improvements.

(3.) That certain stations require more active and extensive works than others, and amongst the rest Bangalore, which requires a pure water-supply.

Lastly. That the great desideratum, as shown by the disease and death statistics, is a very efficient surface and subsoil drainage of stations.

1st August 1884.

LIBRARY OF THE BOMBAY BRANCH OF THE ROYAL ASIATIC SOCIETY

No. 16.

Memorandum of the Army Sanitary Commission on the Medical History of the European Troops in the Bombay Command for 1882.

1. There were 10 arrivals of troopships at Bombay during the trooping season 1882-83. The first was on 30th October 1882, and the latest on the 11th April 1883. The following were the numbers disembarked at Bombay:—

Officers	569
Ladies	115
Children	63
Men	2,228
Women	305
Children	459
Female servants	17

The first troopship of the season, the "Euphrates," carried officers and men from Alexandria, and families from Mediterranean stations.

2. During these outward voyages there were 879 admissions and three deaths among the troops. One of the deaths was from pneumonia, one from remittent fever, and one from enteric fever. It ought to be stated that there were 20 admissions for pneumonia, of which 9 took place during the second voyage of the "Euphrates," and these were attributed by the medical officer in charge "to cold and insufficient clothing, some of these men having not even a flannel shirt." These facts and the mischief resulting require no comment.

3. Of the 879 admissions, those from venereal diseases stood as follows:—

Primary syphilis	127
Secondary syphilis	21
Gonorrhœa and its sequelæ	182
Total	330

The ratio from this class of affections was about 37 per 1,000 on the numbers embarked at the outports. But in the table the ratios are calculated on the average strength for a year, which was 754. Consequently the ratios apply not to the real point at issue, namely, the proportion of cases to strength developed during the outward voyages, which was the cause of complaint on the part of the Bombay authorities.

Taken on the annual strength the ratios were of course very much higher, as will be seen from these figures:—

	Ratios per 1,000 per Annum.
Primary syphilis	168·4
Secondary syphilis	27·9
Gonorrhœa	233·4
Gonorrhœa, sequelæa of	8·0
Total	437·7

If the statistical comparison were altogether admissible, the same diseases, which yielded an admission-rate at the Bombay stations of 200·1 per 1,000 per annum, would appear to have yielded a corresponding ratio for the voyages of 437·7 per 1,000. This will be enough to state on the question of ratios, but otherwise the fact is sufficiently startling, that during a month's voyage of 9,228 men, who bore no trace of the disease on embarkation, 330 cases of veneral disease should have become developed.

4. One officer died of intestinal disease, which did not admit of a chance of successful treatment, and one child died from congestion of the brain. The sanitary condition of the troopships is stated to have been good, the accommodation sufficient, and the quality and quantity of the provisions satisfactory.

As regards dates of arrival at Bombay, out of a strength of 9,228 men embarked, 6,651 would have arrived by the end of January, and the remainder between the 7th of March and the 11th April.

5. There were 16 return voyages from Bombay between 31st October 1882 and 1st May 1883, of which 11 were made by the ordinary troopships. They would arrive in England in a little more than a month after the dates of departure from Bombay.

The following numbers made the homeward voyage:—

Officers	417
Ladies	122
Children	198
Men in health	8,957
Women in health	423
Children in health	1,617
Invalids, men	1,852
Invalids, women	155
Invalids, children	353
Insanes	108
Convicts and bad characters	147

The dates of departure show that 1,149 male invalids left Bombay late enough to arrive at home in the warmer part of the spring. But the remainder would all arrive in cold weather.

Army in Bombay.—The average annual strength of troops on service was 10,197. The admissions were 14,338, the deaths 106, of which 14 took place out of hospital. The average number constantly sick was 626·90. These data give the following ratios per 1,000:—

Admissions	1,406·1
Deaths	10·39
Constantly sick	61·48

The invaliding amounted to 35·11 per 1,000 strength. These ratios showed greatly improved health during 1882.

7. The chief admission cause was paroxysmal fever, from which 128 men were constantly in hospital. The admission-rate from this cause was 498·5 per 1,000; but the previous average three years rate was 898 per 1,000, showing a great reduction. There were 812 admissions from continued fevers, 10 admissions from cholera, primary syphilis is credited with 706 admissions, and secondary syphilis with 254. Gonorrhœa and its results gave rise to 1,080 admissions, so that admissions from the venereal group were 2,040. After fevers, venereal admissions were the most numerous, and then followed diseases of the digestive system with 1,863 admissions.

We shall state briefly the facts regarding the chief death causes of the year.

8. *Cholera.*—The entire cholera mortality took place in the last half of the year, and at three stations only. At another station there was two non-fatal cases. The whole are shown in this abstract.

Stations.	Cholera.	
	Cases.	Deaths.
Deolalee	2	—
Nusseerabad	6	5
Neemuch	1	1
Indore	1	1
Total	10	7

9. *Enteric fever.*—Of this fatal disease there were in all 43 cases and 18 deaths, and they took place at the following stations:—

Stations.	Enteric Fever.	
	Cases.	Deaths.
Bombay	9	4
Belgaum	2	2
Aden	1	1
Kurrachee	7	1
Poona	1	—
Ahmednagar	1	—
Mhow	3	1
Nusseerabad	13	8
Indore	1	—
Neemuh	6	1
Total	43	18

When compared with the proportion of deaths to cases, it almost appears as if, at Kurrachee and Neemuch, there had been a number of continued fever cases with enteric complications which it was difficult to distinguish during life from true enteric fever. There were in the whole command 812 continued fever cases, of which 19 proved fatal, and of these, as we have seen, 18 were enteric fever deaths. To paroxysmal fevers were attributed 10 deaths, raising the total fever mortality to 29 deaths, or 27·3 per cent. of the total mortality of the year.

10. Under diseases of the digestive system are ranked dysentery, diarrhœa, and hepatic disease, from which there have been reductions in admissions and deaths in all the circles. The ratios for 1882 were the following:—

Diseases.	Admission per 1,000.	Deaths per 1,000.
Dysentery	12·6	0·20
Diarrhœa	47·0	0·10
Hepatitis and abscess of liver	18·0	0·69
Total	78·0	0·99

There were in all 133 cases and two deaths from dysentery, and 184 cases and seven deaths from hepatitis, &c., which are the more important diseases. We can only hope that the reduction in 1882 represents the spread of temperance and better personal management.

11. The next abstract gives the admission and death-rates, together with the invaliding in the three arms, leaving out the smaller services.

Arms.	Ratios per 1,000.			
	Admissions.	Deaths.	Invalids.	Constantly Sick.
Cavalry	1,094·8	6·16	43·12	59·22
Artillery	1,249·9	10·32	34·01	56·32
Infantry	1,538·1	19·98	36·06	66·17

It will be seen that the infantry yield the largest proportions of all the elements of inefficiency except as regards invaliding.

The fact has been long known, and has been partly ascribed to the less active and more sedentary lives of the infantry, and to intemperate and vicious habits following thereon. It is satisfactory, however, to find that mortality and invaliding showed a marked reduction in all the ranks, except in the case of commissioned officers, who sustained an increase over the previous average mortality of a single death.

12. The facts under this head are shown in the following abstract:—

Ranks.	Ratio per 1,000 Strength.			
	Deaths.		Invalids.	
	10 Years' Average, 1872-81.	1882.	10 Years' Average, 1872-81.	1882.
Officers	13·23	19·61	35·33	39·02
Non-commissioned officers	19·38	14·33	43·71	40·47
Privates	15·10	9·38	48·60	34·40

The lower rates of 1882 do not, however, represent an absolute total gain, because the death-rates vary considerably in individual years and may rise again; all the table shows is, that 1882 had rates much below the average except in deaths of officers, and it is hence hopeful for the future, if sanitary work and improved personal habits among the men are pressed forwards. A little relaxation in effort would soon show itself in the statistics by higher inefficiency rates.

13. Similar statistical data are given for each station, but they can scarcely be used for comparison, as many of the stations are only occupied by a few men. There are certain of them, however, which give evidence of persistent unhealthiness, and hence require notice. Mhow, for example, with 1,350 men, had an admission-rate, in 1882, of 1,573·3 per 1,000, which is very high, but is still nearly 200 per 1,000 under the previous 10 years' average. Neemuch, in the same way, out of a strength of 434, had an admission-rate of 2,912·4 per 1,000, against a previous 10 years' average of 2,130·7 per 1,000, showing an increase in this case of 800 per 1,000. In both of these cases there had been a reduction in death-rates from a 10 years' average of 11·23 per 1,000 to 6·67 per 1,000 in the case of Mhow, and from 26·69 per 1,000 to 16·13 per 1,000 in the case of Neemuch. Nusseerabad shows the most persistent unhealthiness, as is proved by the fact that its 10 years' average admissions were 1,744·3 per 1,000. In 1882 the rate was lower, namely, 1,357·8 per 1,000; but the amount of fatal disease has been much the same, namely, a 10 years' average death-rate of 23·06 per 1,000, represented in 1882 by a ratio of 23·94 per 1,000. The strength at Nusseerabad was 668 men. At Kurrachee, with 798 men, the average admission-rate of 10 years was 1,793·2 per 1,000, which was very high; but in 1882 this rate had risen to 2,492·5 per 1,000, while the 10 years' average death-rate, which was 18·89 per 1,000, had fallen in 1882 to 3·76 per 1,000. At stations with few troops very little difference in the numbers of admissions and deaths either raises or lowers unduly the ratios. But, making allowance for this, the station rates appear to show that good local sanitary work has been done, which has borne fruit, except in cases where there are local malaria causes which have not yet been dealt with. There the admissions are high; and the practical teaching of the present report is that, while there are stations which require special drainage measures, at all the others much good may be done by simple drainage for ridding the subsoil of water. Three stations, Mhow, Neemuch, and Nusseerabad, have been specially examined and reported on by Mr. Hewlett, the Sanitary Commissioner of Bombay, and we have discussed his reports elsewhere. There is some information, however, in regard to Neemuch which may be here quoted, as confirming our previously expressed opinion as to the causes of unhealthiness there. The medical officer in charge says, "The "remarks I have made on the physical geography of this station and its vicinity will, I think, suffice "to show that the site of the barracks occupied by the European troops is an eminently malarious "one. To the west is the Leora tank, from which the wind frequently blows directly on to the "barracks, and which during and after the monsoon is situated in a swamp. . . . . Again, to "the north of the barracks is a large tract of land which is always, undoubtedly, a source of malaria. "The broken ground in the vicinity of the principal nullahs must also, after an unusually heavy "rainfall, exhale malaria in the superficial drains which permeate the barracks in every direction. "The water is quite close to the surface during and immediately after the monsoon."

The remarkable fact about Neemuch is that in former times it was reputed healthy, while last year 434 men yielded 1,264 admissions to hospital and seven deaths, or 16·3 per 1,000, its 10 years' rate having reached 26·96 per 1,000. We have elsewhere suggested that the facts as a whole appear to show the necessity of spending large sums of money on drainage works, or, failing this, of abandoning the station as one for European troops.

14. There is one station, Belgaum, to which we have called attention in former years on account of what may be called its persistent healthiness, and it might repay the trouble to examine into the causes of this peculiarity, and compare the facts with those regarding the more unhealthy stations. This station had an average strength of troops in 1882 of 812, which sent 824 admissions to hospital, or 848·7 per 1,000. There were seven deaths in the course of the year, or in the ratio of 8·62 per 1,000, which, nevertheless, exceeded the previous 10 years' average, which was 7·24 per 1,000. Among troops of the same nationality, occupying Nusseerabad and Neemuch on the one hand and

Belgaum on the other, there is strong *primâ facie* evidence of presence of local causes in the first two stations not present at Belgaum.

15 Appended to the report under review is a long correspondence on the subject of Mr. Hewlett's reports on Neemuch, Nusseerabad, and Mhow already referred to, further extended in documents sent to this Commission by the India Office, on which a few words may be said.

There appears to be no indisposition on the part of the authorities to do what they can for the improvement of the stations. In this aspect of the case the main difficulty is the expense; but we have always contended that the continued saving of efficiency by the reduction of the various elements of inefficiency, involves a far larger economy to the State than would be effected by withholding the capital outlay required for the improvements. But at this point we are met by another difficulty, for Mr. Hewlett's thoroughly skilled opinions and advice on purely sanitary subjects are apparently called in question by authorities who, in the very nature of the case, have not the same means of estimating the facts as their Sanitary Commissioner has had. The man most calculated to advance the State interests in these matters is not the man to smooth over disagreeable facts and mistakes such as those at Neemuch and Nusseerabad. We cannot enter further on the discussion of these differences of view, and we have alluded to them solely for the purpose of setting prominently forwards the obvious principle in sanitary administration, as in all other State departments, that the opinion of the skilled officer is the one to be adopted and acted on if possible, and that any cause for not adopting the advice tendered should not rest on a difference of view between the unskilled and the skilled official, but on the impracticibility or only partial practibility of giving effect to the skilled advice, which is always a matter admitting of free discussion.

16. Under the head of "General Remarks" there are some practical points referred to by the Surgeon-General which appear to be worthy of note. A few years ago some exception was taken to the ventilation of certain barracks at Bombay stations on account of blasts of cold air falling on the men at night. This, however, appears to be not a common occurrence, for the Surgeon-General says that, "From 6 o'clock in the evening till late in the following day there is an absence of all movement "of air. The smallest leaf on the tree is scarcely stirred. An atmosphere like peasoup, composed of "smoke from the bazaar and particles of heated dust or sand, rests like a pall upon everything. At "such times people feel as if they could hardly breathe, and it is then that heat apoplexy occurs. "Sleep at night is often unobtainable, even under a punkah with a fringe that all but touches the "face. At such times as these barrack-rooms can hardly be too lofty, too much ventilated, or have "too many openings to the air."

The probability is, however, that these principles, though admissible at many stations, do not cover the whole ground, for there is as distinct evidence that if movement of the air is set up outside it passes over the men in bed, chills them, and induces hepatic affections and fever attacks at some stations. The practical point to be kept in view is, that wherever cold currents of night air are allowed to fall on men while in bed there is more or less danger of chills, and hence the necessity of proper ventilating arrangements in all such cases. The objection lies not against ventilation, however abundant, but against cold-air currents, which can always be prevented while the ventilation itself is not interfered with.

17. The Surgeon-General is, however, quite right in holding that, whatever may be the effect of a chill in setting up a fever paroxysm, the underlying cause which must be dealt with is malaria, which has its source "in swampy ground, or ground that has long been covered by water during the rainy season."

He further points out that it is not sufficient, while selecting a site for barracks, to look merely at the immediate surroundings, and that it is necessary to examine the country for a distance with special reference not only to its condition but to the direction of prevailing winds.

But where barracks have been built on a badly-selected site, then the bad spots should be drained; but if this cannot be done, "the only remedy left to us is to surround the dangerous locality with "belts of trees, and, if it can be done, to plant trees on the ground itself. Complete cultivation of "the ground, and exhausting the malaria from the soil, would, of course, be the most radical cure we "could adopt, as it is certain that malaria disappears before cultivation."

He further cites the experience obtained by planting eucalyptus in Italy, by which the subsoil water level had been lowered from 12 centimetres to 1·95 metres below the surface.

The question he raises about the difficulties of subsoil drainage with rocky soils is one of ordinary sanitary work. Wherever in a tropical country there is a subsoil of sufficient depth to retain water, and if there be a drainage outlet, it should be drained. Wherever there is an underlying irregular rocky subsoil with hollows retaining water, the hollows, if possible, should be drained, but situations of this kind should be avoided. Again, where the actual subsoil, although retaining water after rain, is too shallow to be drained, the best remedy is grass or some low-growing vegetation. Bare surfaces in such positions are not safe. Tree planting, as long since practised in Algeria, particularly of the eucalyptus, for the purpose of sanitation of local malaria-producing ground can be tried especially with the eucalyptus, if it will grow. Of course, the dangerous influence of newly-turned up ground for buildings, roads, clearings, &c. has been long known in warm climates, but this can be provided against by known remedies which we have often pointed out. It is not without interest to remark, that the Surgeon-General, in discussing the sanitary history of the year, has been apparently unconsciously led to lay great stress on the local malaria question, which lies at the root of unhealthiness at most Indian stations, but unhappily, although its paramount importance has been long known and insisted on year after year by ourselves, it has as yet occupied little practical attention in India.

Lastly. These are the main practical points requiring notice in the present year's Report. The statistics show that the current sanitary work of past years has improved the general health of the Bombay European army. But the malaria-generating condition of the subsoil at many stations remains the same. Some stations, as is shown by the statistics, are worse in this respect than others, and in three of these the skilled inquiries carried out by the Sanitary Commissioner have led us directly to the causes.

The only question that now arises is whether, at any reasonable outlay, these causes can be wholly or partially removed by such an outlay as the State would be justified in incurring, or whether benefit might not be obtained by removing the troops during the unhealthy season. The question is a financial and engineering one, for its sanitary relations may now be considered as settled. As the stations differ in their sanitary condition, we would, in conclusion, suggest that most benefit to the general health of the Bombay army would be obtained by spending efforts on improving those which statistics have hitherto shown to stand most in need of improvement.

12th August 1884.

No. 17.

MEMORANDUM of the ARMY SANITARY COMMISSION on the REPORT on ENTERIC FEVER by Deputy Surgeon-General J. W. HEWLETT, SANITARY COMMISSIONER with the GOVERNMENT of BOMBAY, with accompanying correspondence, 1884.

1. This Report is the result of a long and laborious investigation by a skilled sanitary officer into the conditions attending the occurrence of enteric fever cases among European troops at stations in the Bombay Presidency, and its object is to make such proposals of a purely practical nature founded on the observed facts as may lead to a diminution of attacks from this formidable disease among the troops. We are desirous that the object of this inquiry should be clearly kept in view, for although Mr. Hewlett has given very full extracts from authorities on the nature, pathology, and theoretic causes of the disease, this is done simply that the officers to whom belongs the improvement of health of troops may be put in possession of the various opinions which have been held on these subjects.

2. All sanitary work involves outlay of somebody else's money, and the final object of both work and expenditure is improvement of health, and while fully admitting the interest and value of every contribution which has been made to the history of enteric fever, the results can only be, of course, made use of in so far as they are practical, and have been sustained more or less by previous or by analogous experience. For example, it may be true that enteric fevers and other fevers may be conveyed by disease particles so minute or so transparent as not to be recognisable with the highest powers of the microscope, which means that their existence is matter of inference and nothing more, but it is quite evident that a pathology such as this does not admit of being translated into sanitary action, nor would it justify either the expenditure of other people's money or the infringement of personal liberty or convenience. But the case is far otherwise when there is skilled testimony to the fact that enteric fever is so closely related to marsh fevers arising from every-day observable marsh conditions as apparently to justify the opinion held by some authorities that a change of name of the fever to "typho-malarial fever" should be made.

3. Again, it has been held by competent Indian pathologists, while admitting the special pathology of enteric fever, that in a certain proportion of such cases the disease known by the specific name only makes its presence manifest after a previous disease history not belonging to enteric fever, but to intermittent or remittent fevers, and in certain cases it has been held that *post mortem* enteric fever complications were in reality a result of Indian fevers, and hence the specific character of enteric fever has been sometimes denied.

4. In sanitary work the pathology of "invisible" disease particles admits of no application; but if enteric fever is an observed concomitant of marsh fevers or of ordinary Indian fevers, the removable causes of which are more or less known, or of sending immature soldiers to India, or of observed defects in subsoils, water-supply, barrack construction, and the like, we have at once a foundation on which to rest our work. We have called attention to these points in order that the contents of Mr. Hewlett's opening chapter may not be misunderstood by executive officers who might find it somewhat difficult to make their way through the tangle of disease speculations which he has extracted from current literature, and we shall next proceed to give some account of the work itself. But in doing this it is necessary to put forward some excuse for discussing matters connected with this fever which we have time after time made the subject of Memoranda, and our excuse must be the great importance of the subject, and the necessity for restating the whole case as it has been presented anew in the present Report.

5. The course usually adopted with so important a disease as enteric fever is to deal with the disease as such, and to attempt to discover local, personal, and climatic conditions sufficient to

account for its presence specially. This course is attended by the disadvantage that it tends to limit unduly the history both pathological and etiological of the fever, and, by doing so, to shut out facts which otherwise might render us important assistance in understanding the disease and its causes.

We are glad to see that Mr. Hewlett has followed a different course in the present Report, so that, as the Surgeon-General states, "it seems to be more than a report on enteric fever only. It may, "perhaps, be more correctly regarded as an inquiry into the hygienic and sanitary conditions of "military stations in this Presidency, and into all circumstances that can affect the health of the "British soldier in India, the object being to discover, if possible, whether there is anything in his "daily life, the environments by which he is surrounded, the food and drink he partakes of, the "duties he is called on to perform, &c., which can predispose him to attacks of this fever when "exposed to any agency which can originate it."

6. Mr. Hewlett commences his inquiry with the subject, the soldier, and he shows anew how large an amount of the enteric fever which infests European troops falls on young ages in Bombay, as it does in other regions of India. By adopting a 10 years' period, he gives the aggregate strength of European troops at assigned ages in Bombay as follows:—

Ages.	Aggregate Strength, 1872–81.
Under 20	4,129
20 to 24	36,645
25 to 29	32,158
30 to 34	16,264
35 to 39	10,443
40 and upwards	2,299
Total aggregate	101,938

This abstract shows that 40 per cent. of the European Army in India during these 10 years was under 25 years of age.

7. These facts regarding the constitution of the Army prepare the way for discussing the question of ages in relation to liability to enteric fever, and as this relation was established by the late Dr. Murchison for cases admitted to the London Fever Hospital, we shall extract from the Report under review his tabular statement, which establishes his position that "persons under 30 are more than four times as liable to enteric fever as persons over 30."

The table is founded on 5,911 admissions, and may safely be accepted as showing the normal relation of enteric fever to age in London at least.

Ages.	Per-centage of Attacks.	Ages.	Per-centage of Attacks.
Under 5 years	0·98	45 to 49	1·08
5 to 9	9·44	50 to 54	·60
10 to 14	18·16	55 to 59	·33
15 to 19	26·86	60 to 64	·33
20 to 24	19·69	65 to 69	·08
25 to 29	10·15	70 to 74	·00
30 to 34	5·36	75 to 79	·03
35 to 39	3·40	Ages not specified	1·30
40 to 44	2·09		

Soldiers' ages in India which have been practically under discussion in relation to liability to enteric fever are those under 25; and, assuming that all such are included between the ages 15 to 25 in this table, we find that, according to London experience, no less than 46·55 per cent. of all enteric fever admissions fall on the same ages as suffer most in India. The importance of this fact is that it shows that liability to enteric fever attacks at the soldiers' ages is a home liability, and it is this home liability which is transported to Indian climates and to Indian conditions of life and service, there to become rapidly developed and intensified.

8. The following abstract shows the liability to enteric fever of troops at different ages in India after their arrival there, but in this table not the cases but the deaths are classified according to age.

Ages.	Per-centages of Enteric Fever Deaths.
Under 20	26·11
20 to 24	43·58
25 to 29	23·19
30 and upwards	7·12
Total deaths	100·00

In London, 46·55 per cent. of admissions become at the same ages in India replaced by 69·69 per cent. of the deaths. In order to show what this rate really means, it may be further stated that, out of 246 enteric fever deaths, 138 took place at ages under 25, and that, out of 509 deaths from all causes at the same ages, 138 were from enteric fever. Another element in the case is the influence of length of service, which falls most heavily on the younger ages. Thus, out of 105 enteric fever deaths among soldiers having one year of service or under, no fewer than 84 took place in men under 25, while among men of the same ages and with two years' service and under, out of 147 enteric fever deaths 112 were under 25 years of age.

This subject is fully discussed by Mr. Hewlett; we have often insisted on its importance to the efficiency of the Indian European Army, and we shall merely sum up the evidence with the statement, that before young soldiers leave England for India they have already a definite tendency to enteric fever upon them due to their ages, that they carry this tendency with them after a rapid voyage to Indian climates, where the great death-cause everywhere is fever, that this fever tendency is immediately developed when they arrive, and large numbers of men under 25, who might have been useful soldiers, are swept away within the first two years of residence.

9. As already stated, the first influence to which troops on arriving in India are exposed is rise of temperature, and perhaps the simplest way of showing what this amounts to will be to place side the monthly temperature means for three home stations, and similar data for three enteric fever stations in Bombay. These data are contained in the following abstract, and are sufficient for our object:—

Months.	Mean Monthly Temperature.						Enteric Fever, 10 Years, at Bombay Stations.	
	Aldershot.	Edinburgh.	Curragh Camp.	Neemuch.	Nusseerabad.	Kurrachee.	Admissions.	Deaths.
January	32·9	33·6	35·6	61·3	58·2	63·1	22	12
February	42·5	40·7	44·6	68·3	70·0	66·5	21	13
March	46·0	43·2	45·7	75·5	79·1	78·5	16	3
April	49·8	42·5	49·4	84·6	85·3	79·3	34	17
May	53·3	51·5	53·8	88·7	93·8	82·5	34	21
June	56·8	53·8	59·3	84·9	91·7	85·5	15	12
July	62·7	59·1	59·1	78·5	85·4	84·2	14	11
August	65·6	60·4	61·4	77·2	83·8	80·9	42	19
September	58·0	52·8	53·2	77·9	83·8	80·6	70	49
October	50·5	47·5	48·5	77·1	80·8	75·0	56	28
November	38·3	38·7	42·1	71·7	76·3	71·3	47	28
December	37·9	38·0	39·0	65·3	65·4	65·8	30	19
Annual mean temperature	49·5	46·8	49·2	75·9	78·7	75·8	401	232

This table shows clearly how vast is the difference between the home climates which the soldier leaves when he goes on Indian service and the climates he has to contend against when he arrives there. The physiological problem which he has constitutionally to encounter amounts to the addition of 58 per cent. to the temperature he was born and reared in, within a year of his arrival in India. His constitution must either adapt itself to the change or suffer. It will be seen that this is a matter quite apart from local disease causes, and, in fact, refers solely to the subject, the soldier, or to the civilian entering on Indian service, and in both the organism is handicapped before the real struggle with Indian climatic or local causes begins.

10. An important element in the question of temperature is daily variation, the amount of which points to another call which is made on the constitution of young men going to India. Daily temperature variation is of course much greater than average ranges for months or years, but it is usual to give the differences by months. At Aldershot the lowest monthly range is 8·6° in January, the highest 24·8° in August. These are the average daily ranges for the month. At Edinburgh the average daily ranges lie between 8·5° in February and 17·5° in May. In the same way the ranges are between 13·5° in December and 23·4° in May at the Curragh. The daily differences between maxima and minima which these averages represent indicate the amount of compensation which the organism must make for the home climates. But if we take the Indian daily ranges the case is very different. At Kurrachee, for example, we find the monthly ranges vary between 15° and 47°. If we assume the Ajmere data as representing the climates of Nusseerabad and Neemuch, we shall have monthly variations to account with of nearly 50°. Of course, as already stated, these figures are only a kind of index to the daily variations, which are very much greater.

11. These are no more than the elements of temperature with which young men have to contend on first entering the country, and it may be worth while to inquire whether the statistics of enteric fever show any relation to these elements, apart from other elements of climate. For this purpose we must refer back to the preceding table, and we shall take the admissions as affording more reliable means of comparison than the deaths, which necessarily include cases admitted in the previous months. It will be seen from these data that the months of highest enteric fever admission-rates are not necessarily the hottest months. The admissions increase with rising temperature until the maximum of temperature is reached. During this period a sudden check is put on the disease, and then the admissions rise with falling temperature after July, and it is at this period that another very important element enters to modify the fever history, not only of these Bombay stations, but of the whole of India, and this is the rainfall.

12. Up to this point we have traced the young soldier from his home station, and its temperatures and ranges, to the far higher temperatures and ranges of Indian climates, and we shall next see that rainfall, with development of what, for want of a scientific knowledge we call "malaria," exerts a direct and powerful influence on the amount of fever among troops, and then we shall have to trace the relation of these fevers to the present subject of inquiry, enteric fever. The simplest way to show the relation of climate to the prevalence of fever will be to place side by side the average monthly fever admissions among European troops in Bombay Presidency during the 10 years' period 1870–79, in Dr. Stephens' tables, with the monthly estimate of climate given by Mr. Lumsdaine in his annual sanitary reports.

Months.	Admission Rates per 1,000 Strength from Fever.			Empirical Seasons.
	Enteric Fever.	Intermittent.	Remittent Continued.	
January	·2	30·6	4·1	Cold.
February	·2	21·7	4·6	"
March	·2	23·2	8·4	"
April	·3	25·3	11·0	Hot and dry.
May	·2	36·7	12·0	" "
June	·1	35·7	13·3	Rainy.
July	·1	45·3	12·0	"
August	·3	52·3	13·3	"
September	·6	68·9	15·2	"
October	·4	32·0	16·7	Hot and damp.
November	·2	65·5	12·0	" "
December	·2	46·8	8·3	Cold.
Total	3·1	528·5	131·4	

Soon after the setting in of rains the fever admissions begin to increase, but it is in the drying up months that they attain their maximum degree of prevalence until they are checked by cold. Enteric fever increases at the same time as the other fevers, but their relative mortality is a different matter. The average annual death-rate from enteric fever during the same 10 years was 1·75 per 1,000 out of its annual admission-rate of 3·1 per 1,000, while the death-rate from all other fevers was 1·14 per 1,000 strength out of their aggregate admission-rate of 659·9 per 1,000. Rainfall differs greatly in amount in different parts of Bombay Presidency. The lowest annual fall is 7·38 inches at Kurrachee, where the average admissions from enteric fever have been 6 per 1,000, and the deaths 3·63 per 1,000 strength. It is important to remark that at this station the admissions from intermittent fever have averaged 166·7 per 1,000, and from remittent and continued fevers 184·4 per 1,000. These facts prove the existence of local causes of malaria apart from rainfall, but in this instance again we have a large part of the admissions taking place in the monsoon months, June to September, when the rainfall is 5·35 inches.

Nasirabad has a 10 years' average admission-rate from enteric fever of 6·3 per 1,000, and a corresponding death-rate of 4·24 per 1,000. Its admission-rate from intermittent fever was no less than 745·9 per 1,000, and for remittent and continued fevers 81·4 per 1000, and yet its rainfall is only 21·04 inches, all of which, except a fraction, falls between June and September, which months also yield the greater proportion of fever admissions.

At Neemuch the admissions from enteric fever show a 10 years' average of 5·4 per 1,000, and from all fevers, chiefly intermittent, a rate of no less than 1,305·7, and a death-rate of 2·11 per 1,000. The rainfall at Neemuch is 31·97 inches, of which 30·25 inches fall in four months, June to September. At this station, out of 5,562 admissions from paroxysmal and continued fevers, all, except 665, took place between June and the end of the year. August and September are the chief enteric fever months.

13. In this analysis there are facts which do not admit of being disputed: (1), it is proved that men of the ages which yield the highest fever proclivities in India already present the same proclivity at home; (2), that, besides the struggle which has everywhere to be carried on during the growing periods of life, young men sent to India have to contend against the influence of unaccustomed excesses of temperature and temperature ranges, which do most injury on the first introduction to Indian service of unformed constitutions; (3) that, as proved by the disease statistics, there is a large prevalence of those fevers to which the term "malarial" is applied at all the stations of the Bombay Army, as well as of continued and enteric fevers, and that young newly arrived soldiers are most liable to suffer from fevers, especially from enteric fever, at these stations; (4) that the period of the rains and drying up of the rains, is the fever period, but enteric fever is not so much affected by rain as are paroxysmal fevers. Moreover, the amount of fever is not in proportion to the amount of rain, and must be connected with local malarial causes which may be intensified, but not originated by the seasonal rains. In other words, these malarial causes must be sought in the station subsoil or in its vicinity.

14. At first sight these facts would be apparently be sufficient to account for the entire losses from fever, but as part of the question, having a direct bearing on measures of prevention, it is necessary to discuss with the facts in Mr. Hewlett's Report before us, and as far as we have the means of doing so, the relation which enteric fever bears to the other fevers in India. Is it a specific communicable fever, like small-pox for instance, or is it the fatal stage of ordinary Indian fevers, especially of those

of remittent and continued type? This subject has often been discussed, and what we have to do at present is to take the facts adduced by Mr. Hewlett simply as evidence in the case, without necessarily accepting them as finally settling the points at issue.

The first paragraph of Chapter V. in the Report stands as follows:—

"From an examination of the cases which have been forwarded to me by medical officers, it appears "that it is quite the exception for the disease on the patient's first admission into hospital to be "diagnosed as enteric fever, as in a large majority it is ascribed to either intermittent, remittent, or "continued fever, and only when enteric complications arise is the disease changed."

"I also notice that the temperature charts in a large number of cases do not present the same "fluctuations as are met with in England, or as depicted by Wunderlich and other authors as "diagnostic of enteric fever. The absence of the characteristic eruption is also very frequently "observed, and sometimes there appear to be no abdominal symptoms so marked as to attract "attention until a *post mortem* examination reveals the presence of ulceration in the solitary or "agminated glands of the lower part of the ileum."

And even as regards the ulceration itself, Mr. Hewlett states that "it is not an easy matter to make a distinction between it and other ulcers." He adduces the opinion of Dr. Morehead that "disease of Peyer's glands, either in a state of turgescence or ulceration, is not a morbid state "peculiar to typhoid fever. It occurs in cholera, in protracted diarrhœa, in acute muco-enterites, "as an occasional complication in remittent fever, and a frequent one in phthisis pulmonalis."

This part of the question is illustrated by filled-up case sheets and by temperature charts. But it is not denied that cases of true enteric fever have been traced from beginning to end in India. The facts as a whole are adduced to show that, admitting this much, in the majority of cases, the earlier history is not that of enteric fever, but of ordinary intermittents, remittents, and continued fevers, in the course of which enteric fever develops itself or shows that it has been the fatal fever by its *post mortem* appearances. And as regards the origin and spread of enteric itself, Mr. Hewlett says that, from the evidence he has been able to gather, "there seems to be no ground for believing that "enteric fever, which annually attacks and destroys so many young soldiers shortly after their "arrival in India, is in all or even in the great majority of cases due to a specific poison derived "from the intestines of a previously affected person."

15. These statements appear to include the leading practical facts on the whole subject, apart from attempts to account for them by calling in the aid of particulate disease elements. If such were proved to exist they would, of course, enter into the question of prevention. But at present we have to consider how to diminish the amount and fatality of fevers which are apparently related not only to young ages suddenly introduced to Indian climates, with their high and variable temperatures and monsoon rains, but which are, many of them, malarial in character, and, as such, are related to general and local malarial causes, including under this term not only marshy conditions, but all general or local conditions such as are known as predisposing causes of fever.

16. This part of the inquiry is one for which Mr. Hewlett's skilled assistance was utilized by the Government of Bombay, and it includes the local insanitary influences of bazaars and native towns in the vicinity of stations, the condition and influence of local position of individual barrack blocks, the condition of drainage of subsoils, of ground near stations, of conservancy, water-supply and other local causes.

The first step in such an investigation is, of course, to deduce the fever history of the stations, and this is given for 10 years ending 31st December 1881, as follows:—

Stations.	Fever Admissions per 1,000 excluding Enteric Fever.	Total Deaths in 10 Years.				Death-rate per 1,000 Strength.			
		Enteric.	Intermittent.	Remittent.	Continued.	Enteric.	Intermittent.	Remittent.	Continued.
Kurrachee and Ghizree	944·5	47	—	6	3	5·8	—	0·7	0·4
Hyderabad	858·3	7	—	2	—	1·9	—	0·5	—
Bombay	1,001·9	3	3	5	1	0·6	0·6	0·9	0·2
Colaba Depôt	388·3	—	—	2	1	—	—	5·6	2·8
Baroda, 1876-81	1,576·4	3	—	1	—	2·5	—	0·8	—
Ahmedabad and Baroda to 1875	905·4	9	—	3	2	3·5	—	1·2	0·8
Deesa	595·6	11	2	5	1	1·8	0·3	0·8	0·2
Mount Abu	1,160·3	—	—	—	—	—	—	—	—
Taragarh	842·3	4	—	—	—	11·9	—	—	—
Nusseerabad	704·8	30	—	10	—	4·8	—	1·6	—
Neemuch	1,344·4	11	1	6	—	2·6	0·2	1·4	—
Indore	732·7	1	—	3	—	1·1	—	3·3	—
Mhow	757·5	37	3	6	1	2·8	0·2	0·5	0·1
Asirgarh	910·8	1	—	2	—	1·3	—	2·3	—
Deolali Depôt	526·3	—	2	2	—	—	1·8	1·8	—
Ahmednagar	481·6	4	—	4	—	1·0	—	1·0	—
Poona and Kirkee	675·6	36	3	7	—	1·6	0·1	0·3	—
Purhandar	691·2	2	—	1	—	2·2	—	1·1	—
Khandala Depôt	746·2	—	—	1	—	—	—	3·1	—
Satara	473·2	2	1	—	—	1·2	0·6	—	—
Belgaum	338·0	2	—	4	—	1·0	—	0·4	—
Aden	334·6	4	—	1	2	0·5	—	0·1	0·3
South Afghanistan, 1880	987·7	10	—	10	—	23·6	—	23·6	—
Troops Marching	341·0	1	—	4	—	0·4	—	1·6	—
Total	—	232	15	85	11	2·3	0·1	0·8	0·1

This table gives the fever history of every station in Bombay Presidency for an annual average of 10 years, as well as the total fever deaths and their annual rates per 1,000 strength of troops for the same 10 years' period. The deaths from all types of fever and their relative amounts were as follow:—

Fevers.	Deaths.	
	Total Deaths.	Per-centage of Total.
Enteric - - -	232	67·64
Intermittent - - -	15	4·37
Remittent - - -	85	24·78
Continued - - - -	11	3·21
All fevers - -	343	100·00

These figures speak for themselves, and it is quite evident that, out of 343 fatal cases of fever, all of which were submitted to *post mortem* inquiry, and even if no questions be raised as to the diagnosis during life, there were 232 autopsies in which the lesions of enteric fever were found, or in 67·64 per cent. of all the fatal cases. It appears to follow that the real difficulty in estimating the relative frequency of enteric fever lies in the diagnosis, which in India is complicated by the very general prevalence at all the stations of fever of paroxysmal types, as is shown in the preceding table. The fever which, after enteric fever, yields the largest number of deaths, is "remittent," and in the sheets given by Mr. Hewlett this fever type is the one from which transfers to "enteric" fever appear to be most common.

17. Now let us suppose that the disease known in England as "enteric fever" had not been introduced into Indian nomenclature, it is clear that medical officers would have been justified in classing the whole 232 fatal cases entered under the enteric fever head as fatal cases of climatic Indian fevers, and hence the question returns in another form. What characters during life ought to be assumed as proving that a given case of fever is enteric fever? The reply to this question has a special bearing on the treatment, which, of course, lies beyond our sphere of work, but for practical sanitary purposes it is quite obvious that we must group all the fatal fever types under one head and deal with them all on the same principles. And if this course be adopted, the first result that will follow is that the actual per-centage of admissions from all fevers is not a measure of the death-rates of individual stations, for, as is shown in the table, the stations which yield the highest ratios from fatal fever types are not necessarily the stations at which the fever admission-rates are highest, and this brings us to the question really at issue, which is as follows.

18. Given a group of stations with very various per-centages of fever admissions among troops, and at which the ratio of fever deaths is not related to the amount of fever, but to the severity of the cases, by what practical steps can the proportion of the fatal cases be diminished? After many years of discussion and local inquiry it cannot be said that fatal fevers can be traced to any one cause. Were this possible, all fevers, nay all diseases, would be of specific nature rather than the results more or less slow of pathological change. At all events, we have as yet no proof of the supposed fact, and in the present Report Mr. Hewlett has done good service by attacking the problem from the outside, and by raising the question whether the stations as a whole, and in the totality of their sanitary aspects as visible to a skilled and experienced observation, present conditions under which fatal fevers may be expected to occur among their permanent residents. The condition of the stations is discussed in detail, and especially with reference to their drainage, water-supply, conservancy arrangements, barrack construction, bazaars, and neighbourhood. We have noticed on other papers three of the most important of these station reports on Nusseerabad, Neemuch, and Mhow, and we have frequently discussed the condition of other stations where enteric fever cases take place. We shall only add a few illustrative facts.

19. In the preceding station table it is shown that, although the fever admissions among troops exceeded 1,160 per 1,000 at Mount Abu, there had been only two enteric cases, but no fatal fever cases in 10 years. In 1882 this immunity ceased so far as concerned the civil population, and five cases of enteric fever took place, due apparently to emanations from filthy latrines. Mr. Hewlett's judgment on this case is as follows: "Especial care should be taken not to allow latrines for natives "to be placed in such deadly situations as ravines, . . . , and much greater attention should "be paid to the sanitary condition of houses and their surroundings, especially regarding the "servants' houses and privies, &c., as well as with reference to the disposal of wastage water, &c. "This course is imperatively demanded, or else it is easy to foresee that some day an epidemic will "occur which will sweep off those predisposed to it by youth and recent arrival." Here we have a purely local outbreak of enteric fever at a hill station traced to very common insanitary conditions, which may exist at any Indian station.

20. At Taragarh, another hill station, there were four deaths from enteric fever in 10 years, out of a strength of 336 men. The water for convalescents is brought from a well at Ajmere, and contains 72·1 grains of solids per gallon, including no less than 17·15 grains of chlorine, with a high proportion of ammoniacal compounds. The question may be very properly asked, who was responsible for selecting a hill station with such water?

21. Indore has not a very high fever admission-rate, but of the admissions 3·2 per 1,000 were due to enteric fever and 9·6 to cholera, and the remittent fever death-rate had averaged 3·3 per 1,000. The medical officer, in 1878, reported that "the bad state of health of the men in August was "doubtless caused by the nature of the soil around the barrack, hospital, and patcherries. This "year many defects have been apparent which in dryer years were not noticeable,—want of deep "drainage, stinking condition of parts of the soil in barrack floor." We have here causes enough for any amount of fever and bowel complaints.

22. The enteric fever at Ghorpuri barracks, Poona, is described by the medical officer as malarial fever, in course of which "enteric symptoms only developed themselves after prolonged illness," which he ascribes to "the general malarious influence prevalent throughout the lines," and this Mr. Hewlett ascribes to bad selection of site.

23. Belgaum affords experience of an opposite kind. It has one of the lowest fever admission-rates (383 per 1,000), and yet in 10 years it lost 13 men from enteric and remittent fevers, the causes of which must be looked for elsewhere than in malarious position. A neighbouring foul tank and bazaar, a large native town, and imperfect disposal of night-soil appear to have been exciting causes.

24. Baroda and Ahmedabad had 12 enteric fever deaths, besides four from remittent and two from continued fevers. Of the former Mr. Hewlett states that the ill-health of British troops "is *very largely* to be ascribed to the infraction of well established and well recognized sanitary laws." There are political considerations about this station which should be overruled in providing for the health of the occupying troops. Ahmedabad simply exhibits the consequences of a badly selected site. At Ahmednagar there was an outbreak of enteric fever, due apparently to the accidental pollution of the water-supply.

25. Kurrachee, which is a well-known fever station, is described by Mr. Hewlett as follows: "The site of the camp was originally selected without due appreciation of its sanitary defects, as "I suppose no one would now say that it is desirable to have a mangrove swamp four square miles in area to windward at a distance of about a mile and three-quarters from barracks." This evil has been increased by closure of the sea inlet by a railway embankment. But besides these fundamental defects, the whole place requires the work of an experienced sanitary engineer to improve it. We formerly suggested that probably the least expensive remedy would be to remove the station to Ghizree.

26. This brief sketch will be sufficient to show the general character of fever causes at stations, but there are other causes which prevail almost universally, and which are connected with the sanitary condition of bazaars and towns to which soldiers resort,—water supply, habits of the men, &c. In regard to bazaars, &c., Mr. Hewlett says that "almost without exception, they are in an unsatisfactory state from a sanitary point of view." In these bazaars the soldier resorts to the very worst localities, amongst the lowest caste people, where he is surrounded by filth and nuisance, and is exposed to other diseases besides venereal affections. The cantonment magistrate has only limited means of dealing with disease causes such as these places present, but it is quite evident that, in any general measures to be adopted for the prevention of enteric fever, the bazaars must be improved to a much greater extent than has been hitherto done. A similar remark applies to native towns near stations. The Report contains much interesting information on the question of water-supply, provided by the Government analyst. The waters differ very much in purity and impurity at different stations, and even within the same cantonment limits, and the evidence yielded by the analysis shows that, in any scheme for the improvement of a station, the water-supply must be accounted with. Bad wells must be improved or discontinued, and better sources of supply provided, and improved means of distribution must be adopted. The mussack is quite out of date.

27. *Barracks.*—Mr. Hewlett makes some remarks on barracks, which require notice. He says they are generally very fine buildings, but that it was a mistake, in his opinion, to issue standard plans applicable to the whole of India, from Cape Comorin to Peshawar. There can be no doubt of this position, nor of the view that it would be better in the present sanitary condition of sites to have constructed buildings of less expensive character, and which could have been replaced in 20 or 30 years. We have discussed this question in our "Suggestions," and we shall merely repeat that permanent costly buildings should only be erected on carefully prepared and drained sites, because an undrained site is a camp site and nothing more, whatever may be the cost of the buildings, and, like any other camp site, it becomes sodden and unwholesome after a time. When this takes place with a camp it is shifted, as a matter of course, but a costly barrack cannot be so dealt with, and fever among the troops is the result.

28. There are many details in the every-day sanitary administration of stations, which Mr. Hewlett shows could be improved with advantage, but so long as stations are without house and subsoil drainage, no completely efficient sanitary system can be carried out. All that can be done is to aim at the best possible result, with defective means and methods.

29. In dealing with the fever question as a whole, and in its sanitary aspects, it appears to us to be impossible to separate between the fever types. There is no proof of the specific character of Indian enteric fever, or its connection with any specific cause, such as would enable practical measures to be taken against it. This position does not interfere with any opinions formed by medical officers at the bedside, or with any measures founded on them which they may think it desirable to pursue in particular cases. But it amounts to a distinct statement, founded on evidence,

that the doctrine of specific causes does not admit of being practically applied in our endeavours to diminish the prevalence of enteric fever at Indian stations.

30. The first and most important step in this direction is to raise the age at which soldiers are sent on Indian service, and to complete their drill before going out. Second in importance must be considered their location at hill stations, provided these are kept in a healthy condition, which is far from being the case with many of them at present. Then, as regards the stations, Mr. Hewlett's inquiry has shown that, in the present condition of stations, no other remedies are required or indeed are applicable than remedies needed against the whole tribe of fevers. The liability to fevers of every station in Bombay is now well known, and the remedies have been long pointed out. Certain stations scarcely admit of the required improvements except at such a cost as to raise the question of removal of the troops or of the cantonment to a healthy locality. Taking the stations as a whole, if the question were put whether they do or do not present fever characteristics, it would be difficult to say whether in any case a negative reply could be given. They appear all to want drainage of some kind, partial or total, and in the best practicable manner, to drain underground water-holes or to free the whole subsoil as rapidly as possible of water after rain, and so to cleanse it and keep it clean. The intermingling of fever types and the apparent passing of a less dangerous into a fatal type of fever at most of the stations, the universal prevalence of malarial fever together with or passing into fever types known by other experience to be due to filth causes, all point to foul undrained malarial subsoils as causes to be at once dealt with.

31. Again, the sanitary problem presented by any particular station involves the condition of bazaars and native towns or villages frequented by troops. It is known, in regard to cholera, that it first appears among natives before it extends to troops, and a common practice has been to keep troops from going into places where cholera prevails. Precisely the same precaution is required in regard to fevers, which Mr. Hewlett tells us prevail extensively among native population groups, including enteric fever among others. All facts and arguments point in the same direction, namely, that the only way to reduced fever mortality is to root out of stations, and of all places frequented by the troops, the well-known local causes of these diseases, or as an alternative to keep the troops out of places where fevers are set up by bad sanitary conditions.

32. As affecting the general health of the soldier at Indian stations, Mr. Hewlett insists on the importance of improving his habits, diet, abolishing the use of spirits as a drink, and similar measures. In fact, all form part of the same precautionary system, and their object is to introduce the soldier by degrees and with due care to the great constitutional changes which must be undergone by rapid change of climate, and by the duties and habits of Indian military life.

Lastly, it would be out of place to go further into details, as these have been fully dealt with in the Government Resolution, and in the accompanying letters of the Quartermaster-General and Surgeon-General. It is most satisfactory to see that the importance of the whole question of these fevers in their relation to the sanitary condition of stations, and to the habits of the men, is fully realised by all parties, and that Mr. Hewlett's Report has been warmly appreciated, and not more than it deserves, by the executive authorities, to whom will now appertain the duty of giving practical effect to the necessary sanitary works and measures.

12th September 1884.

No. 18.

Memorandum of the Army Sanitary Commission on Report of Special Committee of Inquiry into the History of Cholera in India, 1862 to 1881, with reference to Cholera in the Punjab during the latter year.

1. On 19th September 1881 the Government of India appointed a Special Committee, consisting of Colonel C. A. Hall, President; Lieut.-Colonel Stevens, and Major King-Harman, members, and Surgeon-Major H. W. Bellew, C.S.I., member and secretary, "to inquire into the recent prevalence of cholera in certain portions of the Punjab." The Committee was left to determine the localities, but the Government directed their attention in the first instance to Lahore, Murree, Delhi, Umballa, Jullunder, and Sealkote. They were to collate the history of cholera in India during the last few years with that of the Punjab. They were to give details for each district, including the sanitary and other local conditions of the districts submitted to examination, and to compare the local conditions of affected localities with those of localities which had escaped the epidemic, including under this head the meteorology of districts.

They were to follow the same line of investigation in dealing with military stations and troops.

"Having carefully examined and recorded all the facts," the committee was instructed to draw the general conclusions "which these facts appear to warrant," to avoid all theoretical discussions, and to make such recommendations as seem best to them for the prevention of the disease in future years, both among the people generally and among the troops, and for the mitigation of outbreaks when they occur. . . . The report should be as concise as possible," and was to be illustrated with rough charts.

2. Looking at these instructions from our own point of view, we should have considered them as of a purely practical nature, with the intended object of making any addition which might appear as the result of local inquiry to procedure hitherto accepted and followed in the Punjab during epidemic periods. We should certainly not have so interpreted them as including within their sphere anything like an inquiry into the whole statistical history of cholera, and its relation to rainfall over India, still less so into collecting every local story about cholera contagion, which might have come before them. The Government of India has, however, disposed of this mistaken view, in such a way as to render any further notice of it unnecessary, for in their Resolution on the Committee's report, they say: "The President appears to have approached the inquiry with his mind made up to a theory of cholera "contagion, from which all other members of the committee eventually dissented. The consequence "of this has been that the witnesses were not subjected to any sufficient cross-examination, and their "statements have, in many instances, not been properly tested or analysed, while the so-called sum-"maries of evidence prepared by Colonel Hall are practically little more than the expression of his "own inferences, and are declared by his colleagues in almost every instance to be at variance "with the conclusion at which they had arrived, and to be insufficiently supported by the facts before "them."

3. It is no part of our duty to discuss the abstract question of cholera contagion, but in the presence of this decision of the Government of India, we think it right to call attention to the influence which this doctrine has exercised in India as elsewhere, in interfering with the advance of sound sanitary investigation, and also with sanitary work. It almost appears as if "contagion" and "local cause" were two principles of action diametrically opposed to each other, and we do know that they lead to quite opposite methods of dealing with epidemics, and this in face of the long-continued experience that procedure founded on the contagion doctrine has never in India led to the arrest of epidemic advance for one hour, while local sanitary work has, as a matter of experience, mitigated or prevented the incidence of disease during epidemic periods. The final decision of the Government of India on this part of the inquiry and report is stated as follows: "Under these circumstances, the Governor "General in Council considers that it would be mere waste of public money to print the voluminous "record of the local inquiries made by the Committee. It is much to be regretted that the course of "action adopted by Colonel Hall, as President, has rendered fruitless what might have been a very interesting and useful investigation."

Such being the case, we must confine our remarks solely to the part of the Report which has been been printed, and we cannot of course deal in any way with the unpublished portion of it.

4. The Report is described by the Special Committee, in their letter transmitting it to the Government of India as follows: "Our Report consists of three sections. The first section contains the "record of the investigations made at the several stations which were visited by the Special Com-"mittee. The second section consists of the history of cholera in India from 1862 to 1881. The "third section contains a statement of the practical measures we recommend for the prevention or "mitigation of the disease in future years."

For reasons stated by the Government of India, the first section could not be printed. Of the second section the only portion which has been printed is that which relates to the statistical history of cholera in the Punjab, but the topographical and meteorological data appear to have been left out from want of time. Similar data have been prepared in manuscript for all the provinces of India, and these were nearly ready for the press. The Punjab data are followed by a summary of the statistical history of cholera for the whole of India, together with the inductions drawn from the facts, prepared by Deputy Surgeon-General Bellew, the Sanitary Commissioner for the Punjab.

The entire second part is included in one volume, and the third part, which contains the recommendations of the Committee, occupies three folio pages of type.

The Punjab data occupy 216 quarto pages of type, Mr. Bellew's summary 135 pages, making together a volume of 351 closely printed pages, and from this fact we may perhaps estimate not only the great extent of the work done, but the size of the Report if the whole had been printed.

It cannot be said that there is much original matter in this Report. It is mainly collected from documents already printed, and the Punjab data may be useful for reference if so required. Mr. Bellew's summary, however, possesses considerable interest as a contribution to cholera history, partly as a continuation of the important work of the late Dr. Bryden, and partly because it contains etiological views of its author which we shall notice.

5. It is scarcely necessary to discuss the statistical histories, as we have dealt with these for each province year after year in previous Memoranda, and, besides this, the questions at issue are purely local questions, on which the general statistical history can throw no light except as to comparative intensity and periods of cholera prevalence, and the relation of these to epidemic movement, points which are of most importance in the cholera history of a specific year.

Such being the case, we shall limit our remarks as much as possible to any practical results which present themselves in those portions of the Report now before us in type.

6. The following is the definition of cholera adopted by the Committee as their groundwork: "The train of special symptoms may be broadly expressed as consisting of more or less sudden and "violent vomiting and purging of what are called rice water evacuations, followed quickly by collapse "and suppression of urine, which may speedily produce death or may terminate in recovery."

This definition excludes a vast number of milder diarrhœal cases, which precede and accompany all epidemics of cholera, but the object in adopting it appears to have been to confine the discussion as nearly as possible to that form or stage of the disease which approximates most nearly to death, which last is the only condition dealt with in the statistics.

The next point discussed by the Committee is an important one, namely, whether any of the popular theories of cholera can account for or be made to include the facts brought out in this voluminous inquiry. Their answer under each head is as follows:—

7. *The blood poison theory.*—"The existence of such a poison not having been ascertained to be a "fact, the belief in a primary blood poison in cholera has made no advance, but tends rather to be "superseded by other and more plausible explanations."

8. *The cholera contagion theory.*—"This theory asserts that some part of India is the native seat of "the origin and the prime centre of the diffusion of cholera, and that this diffusion of cholera is "effected by human agency, either in the bodies of individuals who have been exposed to the influence "of the disease, whether personally affected by it or not, or in the articles of their clothing, or "luggage, or merchandise, under certain conditions of their contamination by the material of cholera "discharges." After citing the momentous conclusions of the Constantinople Conference based on this theory, the Committee say, "The validity of these conclusions is not supported by our experience "of the behaviour of cholera in India, and the belief in the contagion of the disease, which has never "been generally held in those parts of the country in which cholera is a constant visitor, is now fast "disappearing in most parts of the country. The experience of every day in India, as is amply "illustrated in the following history of the behaviour of the disease year by year, very clearly teaches "that outbreaks of cholera do not travel in all directions as human beings do," and with reference to the exportation of cholera from India, they say, "There is the patent fact that the enormously "increased sea traffic betweeen India and the countries of Europe, since the opening of the Suez "Canal, has been followed by no commensurate increase of epidemic cholera in those countries."

9. *The water contamination theory.*—This is known as Dr. Snow's theory, and was promulgated in London in 1848, at a time when the water-supply was loudly complained of. "This theory asserts "the propagation of cholera by means of drinking water which has been contaminated by the matter "of cholera evacuations. . . . This theory, though long since considered untenable in England, "still has many advocates, and in India is about the most popular of all the theories which have been "hitherto enunciated to explain the appearance and spread of cholera, and yet it is apparently the "least tenable of them all. . . . . In India the water of streams, of tanks, and of wells, is "there is no manner of doubt, contaminated to a great extent by a variety of impurities, cholera "discharges amoug the number, more especially wherever man is settled in large communities with a "fixed residence. But this impurity of the water used for drinking purposes has not been found to "produce cholera. Although it is often enough one of the most prominent of the insanitary conditions "which are found to be present in places where cholera is prevalent, it is immeasurably more often "found to be present in places where no cholera prevails, the two classes of places being in many "places either contiguous or in close proximity in one and the same locality, but in the majority of "instances widely separated and in different localities."

Cholera excreta, like other non-cholera impurities, may pollute the water-supply of a locality, "(*a*) by surface drainage after rains washing the matter of cholera discharges which have been thrown "upon the ground into neighbouring streams and tanks, and into wells which have open mouths "unprotected by a parapet; (*b*) by the wind carrying dried excreta in dust into the water sources; "(*c*) by washing clothes or throwing corpses into water sources."

But while admitting these sources of water contamination as possible, and also that impure drinking water "may favour the attack of cholera in the individual by injuriously affecting the standard of his general bodily health," they point out that cholera poisoned water can only come into operation "after the disease itself is established in its activity," and that the statistical history of cholera which has been the result of their inquiry proves that causes of this class would not account for the facts. "There is no evidence to show that impure drinking water has anywhere in this country originated "an attack of cholera, and far less developed an epidemic of the disease.

There is thus no proof from this extensive inquiry that impure water has exercised any specific influence in the production or propagation of cholera in India, although in India, as elsewhere, water containing animalized matter in a state of putrescence, whether proceeding from healthy or choleraic discharges, may act as a predisposing condition when cholera is present in a locality. Existing putrescence appears to be the element required, and not any supposed specific poison. Hence impure water sources might be innocuous if the decomposition of organic matter were complete, and only nitrates remained, but almost poisonous if drank while putrescence was in progress.

10. *The germ theory of cholera.*—"This theory assumes the existence of a specific cholera germ or "entity endowed with life, a living organism of the fungus kind, which, being swallowed in food or "water, becomes infinitely multiplied in the intestinal canal, and causes by its action the symptoms "which constitute cholera."

The primary source of the "cholera germ" has usually been considered to be the soil, where its production or increase was related to certain soil impurities and conditions of subsoil drainage, water level, aeration, &c. The "germ" must also be present. A modification of this view, but of a much more scientific character, was propounded by the late Dr. Bryden, who, from a very extensive and careful inquiry into cholera history and statistics, arrived at the conclusion that cholera miasm was allied in its course to malaria, and that, like malaria, if transported by winds from the place of its origin, it could not reproduce itself, but must become extinct after a specified time unless renewed in the same way.

The facts on which Dr. Bryden rested his view are patent in the statistical history of every epidemic, but if the ordinary "germ" idea were introduced, there would be at once a contradiction between the

theory and the facts, *i.e.*, that facts would indicate a certain very definite history, while the germ addition would render such a history untenable.

The "germ" idea is also an element in the question of cholera contagion, but it must never be forgotten that the existence of a specific cholera germ has never been proved, and that whether cholera is due to contagion is a question still undecided. Although the first part of the present Report was based in its deductions on the contagion views of the President of the Committee, the final judgment upon it pronounced by the Committee as a whole is as follows: "The spread of "cholera by infection must be looked upon as a very subordinate contingency concurrent with the "natural diffusion of the epidemic influence." So very subordinate is it that after experience on the largest scale conducted on the persons of attendants on cholera cases, even in cholera affected localities, we have been compelled to state that a well appointed cholera hospital is about the safest place to be in during an epidemic of cholera.*

11. The Committee having dismissed the various existing theories about cholera in order to examine the facts *de novo*, have fallen back, as Dr. Bryden did several years ago, on the statistics of the disease as the only basis on which such an inquiry could rest. It follows that, in their view, none of the theoretical doctrines which have from time to time found their entrance into medical literature afford a basis on which a history of cholera, or any consistent plans for mitigating or preventing outbreaks of the disease, the final object of their inquiry, could be erected.

12. The plan of inquiry followed by the Committee is thus described: "The statistics of the "cholera mortality of the civil population for the year are presented at the outset. These are "analysed and accompanied by such descriptive matter as we have considered useful in elucidating "the history of the disease; then are noticed the incidence of cholera among the troops, European "and Native, and the jail populations, and the review of the year is concluded with a brief descrip-"tion of its salient meteorological peculiarities, and a note on the nature of the food supply in respect "to cheapness or the reverse."

The rainfall is assumed, not as an index of any direct relation between cholera mortality and rainfall, "but as an index to the general character of the season, the rainfall being a fair guide to the prevailing temperature and atmospheric humidity of the several months of the year."

The data are contained in tabular statements and diagrams, with maps showing the cholera history of each year in the Punjab from 1862 to 1881.

They have been already published in the annual reports of the Sanitary Commissioner, but are now printed together, so as to give in one view the past cholera history in the Punjab among the civil population, British and Native troops, and the jail population; and, so far, the labour has been of use, and will save trouble to future inquiries, but, when we come to ask the question what the use of it all can be towards accomplishing the objects indicated by the instructions of the Government of India issued to the Committee, it is not so easy to give a reply. We have already noticed the chief statistical data in our memoranda on the Sanitary Commissioners' annual reports, and also the topographical and sanitary information about stations and population groups, and the only question which arises is, whether the data, taken as a whole, throw any additional light on the causes of liability to cholera of troops and civil population in the province.

13. The Committee have thrown the totals of the annual tables into summaries for the whole period, and, as these afford useful information on the law of cholera incidence in the Punjab, we shall give them in abstracts beginning with the monthly deaths from the disease for the years 1865 to 1881.

Population,—1868, 17,487,125; 1881, 18,786,107.

Monthly aggregate of Cholera Deaths, 1865 to 1881, viz., for 17 consecutive Years.

Months.	Deaths from Cholera.	
	Total.	Per cent.
January	743	0·67
February	514	0·46
March	705	0·63
April	7,570	6·82
May	19,475	17·55
June	16,288	16·48
July	15,888	14·32
August	21,083	19·05
September	16,870	15·20
October	7,564	6·9e
November	1,558	1·3e
December	577	0·52
Total	110,930	100·00

This abstract may be taken to represent generally the monthly law of cholera prevalence in the Punjab. May, June, July, August, and September are the months of greatest prevalence of the epidemic.

* See the facts stated in Memorandum No. 1 from Dr. Cuningham's report.

14. The next abstract gives the annual deaths and death-rates per 1,000 for the same 17 years, with the addition of 1882.

Years.	Cholera Deaths.	Death Ratio per 1,000.	Years.	Cholera Deaths.	Death Ratio per 1,000.
1865	3,310	0·22	1874	78	0·004
1866	1,051	0·06	1875	6,246	0·36
1867	73,146	2·25	1876	5,736	0·33
1868	532	0·03	1877	29	0·001
1869	9,258	0·53	1878	215	0·01
1870	469	0·03	1879	26,135	1·49
1871	369	0·02	1880	274	0·01
1872	8,727	0·50	1881	5,797	0·30
1873	148	0·01	1882	39	0·002

This table by itself fully justifies the committee in the course they have taken in setting aside all cholera theories, because these appear to have no relation to the facts. None of them throw the smallest light on the history as developed in this abstract, unless endless suppositions be resorted to in place of facts, a method of dealing with scientific questions leading to no reliable practical results.

15. We propose, in the next abstract, to show the distribution of cholera over the Punjab districts for 17 years.

Districts.	Population.	Aggregate (17 Years) Cholera Deaths.	
		Total.	Deaths per 1,000 for the Period.
Delhi	608,850	2,794	4·58
Gurgaon	696,646	5,695	8·18
Karnal	610,927	4,815	7·88
Hissar	484,681	7,497	10·98
Rohtak	536,959	3,440	6·40
Sirsa	210,795	2,489	11·09
Umballa	1,008,860	5,904	5·24
Ludhiana	583,245	2,768	4·74
Sirhind	33,594	563	16·46
Jullundur	783,020	2,260	2·89
Hoshiarpur	938,890	2,510	2·68
Kangra	743,758	5,227	7·02
Amritsar	832,750	10,679	12·82
Gurdaspur	906,126	3,893	4·74
Sialkote	994,458	2,274	2·28
Lahore	775,551	7,599	9·80
Gujranwala	550,576	3,184	5·78
Ferozepore	533,416	6,248	11·71
Rawal Pindi	699,647	6,602	9·43
Jhelum	500,988	3,513	7·02
Gujerat	616,347	1,703	2·60
Shahpur	368,796	1,384	3·75
Mooltan	459,765	678	1·45
Jhang	348,027	357	1·03
Montgomery	359,497	632	1·76
Muzzaffargarh	295,547	1,164	3·93
Dera Ismail Khan	394,364	580	1·47
Dera Ghazi Khan	309,978	877	2·83
Bannu	287,547	1,939	6·74
Peshawar	500,443	7,172	14·33
Hazara	367,318	2,736	7·45
Kohat	145,219	2,734	18·78

The practical information afforded by this table is of interest and importance, for it shows that, for some cause or causes, climatic, topographical, or local, cholera is greatly more prevalent in some districts of the country than in others.

16. The same rule holds good as regards villages and towns. There are in the Punjab 268 towns and 34,973 villages, making together 35,181 population groups, and on a seven years' average, 1875 to 1881, the whole cholera mortality has been furnished by less than 2·9 per cent. of them on an annual average.

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We have long since called attention to the fact that increase of cholera deaths in a district points to a larger per-centage of attacked villages, and to more deaths in those attacked. The severe epidemic of 1879 is a proof of this law of cholera, for the total sum of attacked villages in seven years was 6,022, and of these 3,753 local attacks were due to this one year's epidemic.

17. We shall next give the statistical history of cholera among European and native troops for a period of 20 years.

Years.	European Troops.				Native Troops.			
	Strength.	Admission.	Deaths.	Deaths per 1,000.	Strength.	Admission.	Deaths.	Deaths per 1,000.
1862	17,100	363	203	12·70	22,056	174	87	4·01
1863	16,726	2	2	0·12	22,771	8	3	0·13
1864	16,880	1	1	0·06	20,399	1	1	0·05
1865	14,814	4	2	0·14	21,096	7	2	0·09
1866	13,555	1	—	—	21,489	—	—	—
1867	13,921	477	284	20·86	22,015	192	88	8·07
1868	22,877	—	—	—	21,869	2	—	—
1869	14,240	364	236	16·86	25,787	385	255	9·80
1870	10,993	1	—	—	25,987	—	—	—
1871	14,517	—	—	—	25,172	4	2	0·03
1872	16,428	326	224	13·60	26,240	178	105	4·00
1873	16,629	1	—	—	25,825	3	—	—
1874	15,011	1	1	0·06	25,877	1	1	0·03
1875	14,591	36	44	3·01	25,892	60	26	1·00
1876	16,369	109	81	4·95	25,553	102	57	2·23
1877	15,856	1	—	—	26,447	—	—	—
1878	14,657	1	1	0·07	26,260	—	—	—
1879	14,294	293	227	15·88	19,355	121	75	3·87
1880	13,562	57	44	3·24	21,905	23	18	0·84
1881	15,251	111	82	5·38	29,526	21	11	0·37

By comparing the data in this abstract with those in the preceding table, showing the annual death-rates among the civil population, it will be evident that in all the cases the incidence of cholera follows the same epidemic law; hence we arrive at the conclusion that when cholera attacks stations of British and native regiments, it does so epidemically. The table also shows how greatly more prevalent and fatal cholera has been in times past among European than among native troops, and how largely the cholera death-rate among the former was raised by the Afghan war.

18. We have already given an abstract of the monthly incidence of cholera among the civil population of the Punjab for a period of 12 years, to which may be added, for the purpose of comparison, the following aggregate monthly admissions from cholera among European troops at Punjab stations for a period of 10 years, 1870–79, from Dr. Stephen's statistics:—

Months.	Admissions from Cholera.		Months.	Admissions from Cholera.	
	Total.	Per Cent. of Total.		Total.	Per Cent. of Total.
January	—	—	July	42	6·86
February	—	—	August	195	31·86
March	—	—	September	101	16·50
April	20	3·27	October	115	18·79
May	67	10·95	November	3	·49
June	69	11·28	December	—	—

On comparing the two tables, it will be seen that the monthly incidence of cholera follows the same rule among troops as among the town and village populations. Both classes escape, or nearly escape, cholera during four months of each year, January, February, March, and December. Epidemics set in with the month of April in both cases, and cease or nearly cease in November. The month of maximum prevalence is August. Thus we learn that European troops at Punjab stations are under the same laws of epidemic cholera, whether as regards the annual intensity of cholera or its monthly prevalence, as are the civil groups of population in towns and villages.

19. The next subject of inquiry is the relative prevalence of cholera at each station of European troops in the Punjab, and for this purpose we shall use the 10 years' data, 1870–79, in Dr. Stephen's statistics, as follows:—

AGGREGATE STRENGTHS and AGGREGATE MONTHLY CHOLERA DEATHS at each STATION of EUROPEAN TROOPS in the PUNJAB from 1870 to 1879.

Stations.	Aggregate 10 Years' Strength.	Aggregate Monthly Cholera Deaths.												Deaths per 1,000 Average Strength.
		January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	
Umballa - - -	13,298	–	–	–	1	5	–	–	16	1	–	–	–	1·73
Jullundur - - -	7,875	–	–	–	–	3	–	–	3	3	–	–	–	1·27
Ferozepore - - -	10,400	–	–	–	–	3	–	–	2	1	3	1	–	·96
Mooltan - - -	8,109	–	–	–	–	–	–	–	2	–	–	–	–	·25
Dera Ismail Khan - -	993	–	–	–	–	–	–	–	–	–	1	–	–	1·01
Meean Meer - -	9,291	–	–	–	1	24	3	1	81	6	2	–	–	12·70
Fort Lahore - -	1,130	–	–	–	–	–	–	7	3	–	–	–	–	8·85
Amritsar and Govindgarh -	2,532	–	–	–	–	–	–	–	–	2	–	–	–	·79
Sialkote - - -	10,161	–	–	–	1	4	–	1	–	3	1	–	–	·98
Rawul Pindi - -	16,145	–	–	–	–	3	–	2	3	15	2	–	–	1·55
Attock - - -	1,697	–	–	–	–	–	–	–	–	–	3	–	–	1·77
Nowshera - - -	5,744	–	–	–	–	–	–	–	–	–	3	–	–	·87
Peshawar - - -	15,274	–	–	–	–	4	44	19	10	23	70	2	–	11·26
Hill Stations.														
Murree - - -	5,733	–	–	–	–	3	4	5	19	–	–	–	–	5·44
Cherat, 1871 to 1879 -	3,392	–	–	–	–	–	–	–	1	–	–	–	–	·29
Dagshai, 1870 to 1879 -	8,317	–	–	–	–	–	–	1	16	1	2	–	–	2·41
Subathu - - -	6,645	–	–	–	–	–	–	–	–	9	–	–	–	1·36
Dharmsala, 1870 to 1878 -	651	–	–	–	–	–	–	–	4	–	–	–	–	6·14
Chakrata, 1870 to 1879 -	7,153	–	–	–	–	–	–	–	1	–	–	–	–	·14

During the years 1870—1879 the only hill stations in the Punjab which escaped cholera were Ranikhet, Jutogh, and Dalhousie, and this table shows exactly the relative liability to attacks of cholera at all other Punjab stations. It will be seen that the hill stations conform to the same epidemic rule as to times of cholera prevalence as stations on the plains.

The facts would show that the whole area of the Punjab, including its hills and mountain groups, is influenced by the same epidemic condition of cholera at the same periods of time, and hence the next matter for inquiry is, why the middle and later months are so peculiarly liable to epidemic outbreaks of the disease. Certain of the conditions, such as the sites of stations, troops, general sanitary arrangements, water-supply, remain the same throughout the year, and the only variable conditions are those connected with climate, including under this head temperature, temperature ranges, moisture, winds, their strength and direction, and rainfall, the last including in it the relation of the amount and distribution of rain to drainages of areas and subsoil water-level and dampness of locality. Local dampness of soil and atmosphere, high temperature, and stillness of atmosphere, favour rapid decomposition of all organic matters, and tend to make the air impure, and the Punjab itself has afforded striking illustrations of the connexion of these conditions with cholera outbreaks, as well as of their cessation when great atmospheric movements had taken place.

20. In their Report the special committee have given abstracts of some climatic elements which admit of being used in a very general way, in the relation to the total monthly deaths from cholera, and we shall here tabulate them, to show whether any and what relation exists between these death-rates and the rainfall. As some of the data are taken from Dr. Stephen's 10 years' statistics, we shall assume a 10 years' period as affording sufficient data for our object, and place side by side the death-rates of civil population and European troops, with the annual rainfall.

Years.	Death-rates per 1,000,		Rainfall.
	Civil Population.	European Troops.	
			Inches.
1870 - - -	0·08	—	20·14
1871 - - -	0·02	—	25·38
1872 - - -	0·50	13·60	31·19
1873 - - -	0·01	—	25·17
1874 - - -	0·004	0·06	26·12
1875 - - -	0·36	3·01	35·90
1876 - - -	0·33	4·95	28·51
1877 - - -	0·001	—	29·03
1878 - - -	0·010	0·07	31·24
1879 - - -	1·49	15·88	23·56

It would appear from this table that the average annual rainfall has no very marked relation to the cholera death-rate either among the civil population or European troops. It cannot be said that a small annual fall is attended by a higher cholera death-rate, or the contrary. There are apparent exceptions on both sides, but, looking at the facts as a whole, we may conclude that the actual amount of rain falling in a year, without reference to its distribution and to other meteorological elements, does not afford us any help in tracing the determining causes of cholera epidemics in the Punjab.

21. We shall next inquire whether the rain distribution affords any light on the subject, and for this purpose we shall place side by side the three following elements,—1st, the monthly per-centage of annual cholera deaths among the civil population; 2nd, the same data for troops, using, however, in this latter case, the monthly cholera admissions for 10 years, 1870—1879; 3rd, the monthly per-centage of the 10 years' average rainfall.

Months.	Average per-centage of Cholera mortality among the Civil Population.	Average per-centage of Cholera admissions among European Troops.	Average Monthly per-centage of Rainfall.
January	0·67	—	3·5
February	0·46	—	5·3
March	0·63	—	4·3
April	6·82	3·27	3·0
May	17·53	10·95	4·2
June	16·48	11·28	9·7
July	14·32	6·86	27·2
August	19·05	31·86	25·0
September	15·20	16·50	11·8
October	6·90	18·79	1·8
November	1·46	·49	1·1
December	0·52	—	3·1
	100·00	100·00	100·00

This abstract shows that the average monthly distribution of rain has an apparent relation to the monthly prevalence of cholera, but the comparative quiescence of cholera in the first three months of the year, notwithstanding the fall of a measurable per-centage of rain, would appear to show that lower temperature exerted a certain restraining influence on the disease. On and after April, however, increase of rain is attended with a very decided increase of cholera up to September, after which both decline. It would almost appear as if the cholera cycle was made up of two epochs, one beginning in April and ending in September, and the other lasting thenceforth until April of the following year. During the first, rise of temperature and of rainfall co-exist, and during the second, low rainfall and lower and more variable temperatures accompany decline of cholera.

These results are of course deduced from averages, extending over the whole country; but, in order to appreciate the influence of local climates on cholera prevalence, we shall select two or three of the more important stations of European troops to show this fact, and use the data for 1881, which were the ground of the present inquiry.

Lahore and Meean Meer, 1881.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Mean temperature	55·8	63·9	66·9	81·6	90·4	95·5	88·3	85·5	87·0	79·4	64·1	57·6
Daily temperature range	30·7	26·5	21·7	25·7	30·2	24·	15·9	14·2	22·0	30·5	34·3	31·2
Rainfall	0·63	1·31	2·35	0·57	0·95	0·41	12·39	8·05	0·18	0·12	—	—
Humidity	54	55	64	43	38	44	69	79	59	50	50	53
Cholera deaths, Lahore district	—	—	2	—	2	51	104	318	590	71	5	—
Cholera admissions at Meean Meer and Fort Lahore (strength 1,127).	—	—	—	—	1	44	14	34	—	—	2	—

The results of this table are interesting, for they show that cholera was dormant in the district and military station when temperature and rainfall were low, although the daily ranges of temperature were high. Also that high temperature, with increase of rain, acted rapidly on the amount of cholera, both at the station and among the civil population, although the temperature ranges were not extreme, and that cholera again became dormant with falling temperature and disappearance of rain. Air humidity, although greatest in July and August, when cholera was most fatal, showed a less marked coincidence with cholera mortality than did rain.

22. If we compare the rainfall and cholera mortality of 1881 with the same data for 1880, we obtain the following confirmatory facts showing the relation of rain to cholera. In the former year there were 1,643 deaths from cholera in Lahore district, and 71 at Meean Meer and Fort Lahore, in all 1,714 deaths. The rainfall was 26·38 inches, which was 5·18 inches above the average. In 1880 the deaths from cholera in Lahore district were only 14, and there was not a single case of cholera among European troops, either at Meean Meer or Fort Lahore. The rainfall in 1880, was only 11·27 inches. A striking illustration of low cholera mortality and low rainfall is afforded by Mooltan, which has been always remarkable for its comparative exemption from this disease. We have already shown that out of an average population in this district of 459,765, there had been 678 cholera deaths in 17 years, equal to a death-rate of 1·45 per 1,000 for the period, or 0·085 per 1,000 annually. In 1881 Mooltan did not yield a single cholera death among the civil population, nor a single case among European troops. Now the average rainfall at Mooltan is only 7·17 inches, and in 1881 it had fallen to 4·27 inches.

One other example may be adduced to show that something besides the amount of rain enters as a factor in the determining causes of cholera mortality. The case is Peshawar, which, as we have shown, is one of the most severely affected districts in the Punjab, and indeed in all India. Its aggregate cholera death-rate, for a period of 17 years, has been 14·33 per 1,000 of its district population, and 11·26 per 1,000 per annum among European troops, yet its average rainfall is only 14·35 inches per annum. In 1881 the rainfall was 15·90 inches, an increase of about an inch and a half. But there were only three deaths from cholera among the civil population, and not a single case among European troops in that year.

23. We would not infer from these facts that rainfall has no relation to cholera mortality, for it has been long known that under certain local and climatic conditions a heavy rain will wash out cholera as effectually as it cleanses foul street gutters and sewers, and provides purer water. And in the same way deficiency or absence of rain, with active evaporation, may lead to all local filth causes becoming aggravated, and well waters more impure. But suppose we have an area of ground covered with barracks or houses, which have been allowed to become fouled, or suppose a barrack or camp is placed on foul ground, this question presents itself,—What is likely to be the effect on such a locality of a few moderate showers of rain, no more than sufficient in a warm climate to wet or damp the ground to a few feet from the surface? There can be but one answer; it simply adds the element required to stir up all putrefactive processes into greater activity. Is there no smell, for example, at Meean Meer after rain? And is the site, with its past history of long occupation by native troops before it became a European station, a likely one to escape mischief under certain conditions of rainfall temperature and moisture? We answer that the cholera statistics already given show its precise value in relation to the health of troops.

24. It will be seen that in our view climatic elements in their bearing on cholera prevalence require to be studied with reference to the locality itself, and that climate and its influence cannot be estimated merely from meteorological records. These are invaluable, as containing facts, but not as recording efficient causes of cholera. They afford great help in carrying out local inquiries, especially in warm climates, and ought to be so used. But this is all.

25. There is another point as regards rainfall, besides its local influence on health, which must be taken into account, and this is its effect on food prices during the year, for these have an influence on the susceptibility of the people to epidemics of all kinds, but it cannot be said that deficiency of food is an efficient cause of cholera. The epidemic must be there before starved people can suffer.

26. We have entered on this discussion about climate on account of the prominence given to it in the present Report. Most of the remaining paragraphs are taken up with local cholera history, much of which had been published before in reports of Sanitary Commissioners. They have a certain importance in local epidemiological history, and might be useful in such inquiries, but when we ask the question as to the amount of light they throw on the local etiology of cholera, and what lessons of a practical kind for saving life can be drawn from them, we would, in view of the great labour which has been spent over the details, prefer to express regret that their practical results in this direction have not been deduced by the committee.

27. A similar remark may be made regarding the laborious and interesting extension of Dr. Bryden's inquiry on the general and annual history of Indian cholera by the Sanitary Commissioner of the Punjab, which forms the second part of the volume. In our view, the Government of India has conferred a benefit on civil and military medical officers, by resolving to circulate it among them. It cannot be said that there is anything absolutely new in it, but Mr. Bellew has given in a comparatively brief space the results of many years of local inquiry and observation, all over India, into the statistical history of cholera and its relation to rainfall and food supply. But still the question of local etiology is left unsolved.

It is not that this important question has been ignored, because the Report itself acknowledges the successive diminution of cholera deaths in the Punjab alongside successive advances of sanitary improvements in cities and towns; and the Sanitary Commissioner has, moreover, in his official capacity, given ample proof of his estimate of the paramount necessity of pressing forwards with sanitary work. Our remark applies to the position which local sanitary condition occupies in the Report.

28. The most interesting part of the volume is Part II. of Mr. Bellew's summary, namely, the "deductions drawn from the general statistical summary, together with practical observations regarding the nature and causes of cholera."

The result is not a new theory about cholera so much as a pathology different from the one at present received. The questions raised relate to medical inquiry rather than to sanitary practice, and appear to have assumed their form from certain pre-occupations arising from too great importance being attributed to meteorology in the chain of events. Such a discussion is perfectly legitimate, and may do good by freeing the minds of medical officers from views of a less tenable character, and weakening the influence of one-sided doctrines about this disease.

29. Resting on the known result that statistics of cholera mortality do not convey a correct idea of the prevalence of an epidemic, Mr. Bellew says that this is due to the fact "that cholera is rarely "recognised, or acknowledged as such, until some case ends fatally with suddenness and violence of "symptoms, or until the disease breaks out into epidemic activity, and even then the milder attacks, "although they may prove fatal, occurring at the same time and in the same locality, are rarely, if "ever, recognised as in any way connected therewith. In fact, the malady which is produced by the "cholera influence is not sufficiently recognised as cholera either by the profession or by laymen, "until or unless it manifests the grave symptoms characteristic of the last or most fatal stage of the "severer forms frequently assumed by the disease; whereas, as a matter of fact, and more especially "in seasons of its epidemic prevalence, cholera affects in a mild or moderate degree of severity a "vastly greater number than it kills by the violence of its assaults. . . . . The records, however, "so far as they go, show that cholera in India is a disease, which, in point of prevalence, is very "intimately related to and dependent upon the climatic and seasonal influences of the country both "as a whole and as made up of constituent parts; and further that the effects of these climatic and "seasonal influences, as manifested by the prevalence and fatality of the disease, are in a very "remarkable manner modified and controlled by conditions of locality affecting the soil, the weather, "and the life circumstances of the people."

This view of cholera and its universality is not a new one. It has, on the contrary, been held by some physicians that wherever there is diarrhœa there is cholera, ready to assume its most fatal aspect whenever the required conditions are present. Mr. Bellew discusses the question at considerable length, but it lies beyond our immediate object, except in so far as the practical result is concerned. After deducing the relation of meteorological data to the disease, and showing in this connexion that all the stages from diarrhœa onwards come under the same law of a three years' period, he condemns the usual separation of the last and fatal stage from the general body of the disease, because this view leads to neglect of treatment at the only curable stage, and results in the belief that the severer forms constitute a contagious disease, than which, he says, "no more mischievous practice could be followed." By neglect of the earlier stages "the patient is allowed to drift into a stage of the disease in which treatment by medicine is impotent." While the contagion doctrine applied to the later stages of the disease leads to the result that "an amount of injury and "vexation is caused which has not unfrequently given rise to the expression that the cholera is less "to be dreaded than the doctor." He condemns the precautions usually adopted as "absurd and contradictory;" and, further, he says that "in every outbreak of epidemic cholera, much mistrust and "discontent are produced amongst the people, by our inconsistent measures of medical treatment "and preventive precaution." Amongst other measures of the latter class he condemns the contagion theory practice of destroying by fire the bedding and property of patients without such compensation as the sufferers deem adequate. All these customary quarantine precautions might possibly be justifiable if any proof could be adduced that they had been of the least value. Such proof, however, is totally wanting; and, moreover, if cholera is an epidemic and not merely a stage of an epidemic, such proof can never be obtained, as the whole previous course of the disease has been overlooked.

30. "What then is cholera?" This question, posed anew by the Sanitary Commissioner, is replied to by him as follows. After citing his experience of cholera in England, Turkey, Bengal, and the Punjab, and his acquaintance with the statistics of Indian cholera, and its literature, he says: —"Cholera is simply an influenza or catarrh of the mucous membrane of the alimentary canal, "precisely homologous to the influenza or catarrh of the mucous membrane of the respiratory "passages; and, further, we believe, from an extended, practical, and personal experience of the "maladies now coming under consideration, that the two above-mentioned different forms of influenza "or catarrh are intimately related to a still more different form of the same disease as represented "by the train of symptoms which characterize what are commonly known as malarious fevers, whether "of the intermittent, remittent, or continued forms, and that they are all dependent for their "production upon peculiar conditions of the weather, aided by those of soil and locality, as the exciting "causes, and upon certain conditions of the individual health as the predisposing causes." This view of the nature of cholera and its alliances is fully discussed; but the general conclusion, so far as cholera is concerned, is, that "cholera in India, at all events, is a disease which is entirely "dependent for its origin upon the effects of atmospheric influences acting upon the body through "the skin and lungs, as in the other malarial fevers we have enumerated, modified and controlled no "doubt by the health state of the individual, and the immediately predisposing cause of the attack, "and controlled in respect to mildness or severity of prevalence by peculiarities of epidemic "season."

31. As our present object is to see whether the Report under review throws any new light on means of protecting the health of the troops in the Punjab, it may be well before proceeding further,

To introduce the following data, showing the relation between the monthly per-centages of the annual rainfall and the monthly per-centages of annual admissions among European troops in this province, during a period of 10 years, from the more important diseases:—

Months.	Monthly Per-centage of Rainfall, 1870–1879.	Monthly Per-centages of Admissions from Epidemics among European Troops, 1870–1879.				
		Cholera.	Enteric Fever.	Intermittent Fever.	Remittent and Continued Fever.	All Causes.
January	3·5	—	4·	5·2	1·3	6·1
February	5·3	—	4·	3·6	1·4	5·1
March	4·3	—	4·	3·3	2·0	5·3
April	3·0	3·3	8·	3·9	6·1	6·5
May	4·2	11·5	16·	5·1	13·8	8·1
June	9·7	11·5	18·	5·7	12·3	7·9
July	27·2	5·5	12·	6·4	18·4	8·9
August	25·0	32·88	8·	8·1	13·1	9·5
September	11·8	16·40	10·	14·4	16·3	11·8
October	1·8	18·00	8·	19·2	12·6	12·8
November	1·1	—	4·	15·7	5·2	10·3
December	3·1	—	4·	9·4	2·5	7·7

In order to understand this table, the following totals may be here introduced. European troops in the Punjab, 1870–79; aggregates, 10 years:—

Strength	112,288
Admissions, all causes	207,421
Deaths, all causes	2,326
Cholera admissions	612
„ deaths	444
Enteric fever admissions	536
„ „ deaths	260
Intermittent fever admissions	76,981
„ „ deaths	29
Remittent and continued fever admissions	31,358
„ „ „ deaths	223

These aggregates include the sanitary problems presented by stations of European troops in the Punjab, and by referring to the preceding admission ratios, it will be seen that the more fatal diseases have all an apparent relation to the monthly rainfall. This relation is marked as regards cholera, enteric fever, and remittent and continued fevers. Intermittent fever, on the contrary, increases after the rainfall and during the drying up and variable temperature months. Admissions from "all causes" increase with falling off of rain, a fact which is explained by the very great proportion of admissions from intermittent fever, which considerably exceeded a third of the total 10 years' admissions. It is hence quite clear that the relation of rainfall to this fever is not the same relation as it bears to cholera, or to the more fatal fevers.

The average 10 years' rainfall was 27·62 inches, as the table shows that above 80 per cent. of it fell during the months of prevalence of the more fatal diseases. The mere fall of 22 inches of rain in six months can scarcely be credited with such a result. There must have been some other causes let loose by the rain, and what these causes were, and how they can be dealt with, is precisely the sanitary problem presented by the rainfall at these stations.

32. What really was required in a practical sanitary inquiry, such as the present was intended to be, was that each station should have been taken separately, and an exhaustive inquiry carried out. This has not been done, and the only result is, that during months of maximum rainfall we may look for deaths from epidemic and endemic diseases. The facts which we have abstracted from Dr. Stephen's tables show this clearly enough, but it is precisely at this point that sanitary investigation ought to begin.

The causes to be dealt with cannot be arrived at by any general assumptions such as those involved in the statement that to sanitary precautions "belong all the multifarious details connected with conservancy, ventilation, space, diet, clothing, shelter, occupation, and habits." Even if all this were done for all the stations we should still be without information as to the reasons of great cholera mortality at such stations as Meean Meer, Peshawar, Murree, and the like.

33. A similar remark applies to the third part of the Report on the "Recommendations proposed by the committee for the future prevention of cholera," which we next proceed to discuss.

The first recommendation is one in regard to which there can be no difference of opinion, because [redacted] been all along recognised as necessary, and this is a pure water-supply for stations and their [redacted]uring towns.

[redacted]econd recommendation can scarcely be called a logical one. The committee are of opinion [redacted]thout going so far as to insist upon a general quarantine in all stations which are occupied [redacted] seasons of epidemic cholera, it is of the first importance that such bodies of men, as well as

" prisoners in jails, should be as much as possible prevented from coming in contact with the genera
" public, and they would therefore recommend that paragraph 78 of the rules laying down the measures
" to be adopted on an outbreak of cholera be cancelled, and that it be left discretionary with com-
" manding officers in communication with the civil authorities to enforce quarantine within cantonment
" limits, but that in respect to jails they would recommend that the order for quarantine be com-
" pulsory." Such a proposal as this scarcely admits of discussion. Are the lives of prisoners of more importance to the State than the lives of troops or the lives of the civil population?

If the committee have arrived at the conclusion that quarantine can arrest cholera, why not state the facts on which their opinion is founded? and if these are such as to justify quarantine, by all means let it be adopted universally. But, as we have already stated, the Government of India has passed a sweeping condemnation on the whole contagion part of the inquiry, and quarantine as a preventive measure is out of court.

Curiously enough, there is one modification of interrupted intercourse which is of known efficacy, and the necessity for which is moreover shown by the data in the Report, of which no notice is taken, and this is preventing troops going into cholera-affected localities. The aggregate of evidence over all years included in the committee's Report shows that when cholera prevails in the Punjab, it does so by attacking local groups of population, and that of these groups no more than 2·9 per cent. have furnished the annual deaths. Now it is a known fact admitting of no dispute that healthy people going into an affected locality are peculiarly liable to attacks of cholera, but that if any attempt is made to prevent the people in such localities from leaving them, they in their turn will perish. What commanding officers have to do is simply to keep their men from visiting affected localities. There is absolutely no warrant for trusting to any other measure. The third recommendation applies to the inspection of articles of food, especially during epidemics. This is an old recommendation, and a very proper one. In the fourth recommendation the measures adopted for removing troops from stations are discussed, and the use of railways wherever practicable is advisable to avoid fatigue. In this view we concur, and perhaps it may be useful to state the general principles which in our view ought to regulate the removal of troops.

34. These are as follow:—The aggregate of evidence in the Report goes to prove that, while cholera, as an epidemic, is influenced in its course and history by climatic causes, its attacks are strictly determined by local and personal causes. So far is this the case that it might be possible to form a map for every station showing all the points, for many miles around it, where cholera is likely to be present or absent. In this way a neutral zone might possibly be found, within which troops might be safely placed during epidemics.

Next, every station should be supplied, by telegraph or otherwise, with information as to position and advance of cholera at fixed dates. We have already seen that Punjab stations are quite safe from cholera during January, February, and March, and that necessity for removal does not arise until April, when cholera first appears, but that preparations ought then to be made for the outburst of cholera in May, during which month troops should be removed from Peshawar, Meean Meer, and Murree more particularly. A cardinal point to bear in mind is, that when cholera attacks a station, the station has become an affected locality, and that many more men are under the cholera influence than the number which has been attacked. These latent cases will become developed, whether left in the station or removed, although more may die if left at the station. The occurrence of cases after removal is no proof that removal has failed, but it is a decided proof that the removal has not taken place soon enough, and to men in such a condition fatigue would be injurious, and hence the recommendation of the committee as to using railway conveyance is in accord with the necessities, but the facts also show that it would be better to settle the cases in which removal should take place in April, for May is a distinctly epidemic month, when removal might be too late to save life. In all cases care should be taken to avoid fatigue, and not to expose the troops to wet.

35. The fifth recommendation is an important one regarding better dieting of troops. We have often insisted on this point, and we concur in the general principle laid down by the committee, leaving the details to the authorities in each Government.

36. Besides the recommendations, the committee insist on the relation of dear food to cholera mortality, and they admit the great difficulty of dealing with this aspect of the question. The greatest mortality, they state, occurs more especially among the poorer Mahomedans, "who, for the most part, lived in wretched hovels, poorly clad and ill-fed." This is no doubt true; but, if we cannot clothe and feed the people, we can do something towards improving their surroundings, and the committee fully admit the importance of "the recognized branches of public sanitation, such as drainage, sewerage, conservancy, ventilation, housing," and they conclude by expressing an opinion that, in these sanitary matters, "the system on which the Government has been working for so " many years is an excellent one, and it only remains now for it to be carried out to the fullest " extent possible, and to ensure its efficient maintenance at all times."

37. Could not all this have been advised without a long and laborious investigation, and have the results thrown any new light at all on the great liability of British troops at Punjab stations to attacks of cholera, notwithstanding plenty of food?

38. It would be out of place to make recommendations on the conduct of a finished inqu
perhaps we may be permitted to suggest that, when another opportunity occurs, some light
obtained on this subject if, besides inquiry into general climatic influences and the relati
monsoons to cholera advance and prevalence, further local inquiries were carried out as to

influence of local topography on local climates. Such, for example, as takes place in the case of Murree, or at Peshawar, from its peculiar local position, or at Meean Meer, from stillness of atmosphere. It is possible that slowly-moving masses of air during cholera seasons, or absence of movement, may exert considerable influence on outbreaks of cholera. Hence the importance of paying great attention to the direction and force of winds and prevalence of calms during cholera seasons. Again, the relation of surface and subsoil configuration to rainfall merits minute inquiry. Why, for instance, are some parts of stations more unhealthy than others, and even some buildings than others? Are there impervious beds of clay or kunkur under the buildings, at such a depth or with such configuration as to retain water after rain? Or are the affected localities so situated that infiltration and retention of canal water may lead to similar results? It may happen that drainage of depressions or impervious beds may in some cases go far to remedy the evil.

39. As regards personal hygiene of troops, it may be suggested whether further inquiry might not be made as to the effect of night duty in predisposing men to cholera at the more severely affected stations, or living in common barrack-rooms instead of in separate houses, as in the case with native troops, who suffer so much less from cholera than European troops do. The frequent occurrence of cholera in particular buildings and hospitals would appear to point to the advantage of occasional evacuation of hospital buildings and barrack blocks.

These points are merely suggested as among those which might possibly lead us to some practical results in dealing with cholera in the Punjab. It is not unlikely that many others might present themselves on the spot, but we are obliged to deal with the question generally, as it has come before us.

We have alluded to the advantage of telegraphic communication between stations and affected districts when cholera is moving. This is a matter of considerable importance in enabling conclusions to be arrived at as to direction and times of cholera invasion and the movement of troops; but besides this, the telegraph, if properly used, would convey facts, and enable them to be recorded at the time, of the greatest importance to the general history of cholera and the best means of meeting its advance.

40. In conclusion, in the absence of adequate local information about the more severely affected stations and localities in the Punjab, the practical result of this report is that Meean Meer, Peshawar, and Murree should cease to be occupied by British troops. But in questions of public health we are not disposed to accept such conclusions without knowing the reason why, and this is precisely what the inquiry has failed in. One result of it, however, has been to show the paramount necessity of timely information of the movement of cholera being available, and of timely steps being adopted for removing troops out of these stations. We may repeat what we have said, that, as a contribution to the study of Indian cholera, especially in its relation to certain elements of climate, and the influences of these on cholera, the committee has collected much useful information, but as regards the far more important question why stations and population groups in the Punjab suffer so severely from cholera, and why certain of them yield higher death-rates than others, our knowledge is just where it was.

5th March 1884.

No. 19.

[redacted] Army Sanitary Commission on Papers referring to Fairs and [redacted] in Madras Presidency in the latter part of 1882 and in 1883.

[redacted]tain brief notices of 26 festivals and fairs held in various districts in Madras [redacted]f 1882 and October 1883, but only five of them took place in the former year. [redacted]ending are given in 16 instances, and they amounted in all to above 300,000. The [redacted]ce was 100,000 at Conjeveram. All the fairs were free from cholera except two, [redacted]festival at Srirangam and the Tirupati festival, which again yielded a few cholera

[redacted]angam case, cholera was present in the town when the people assembled, and there [redacted] and 13 deaths among the townspeople. The pilgrims had four cases, of which two [redacted]t of 12,000 people at the fair. It was an instance of persons coming in numbers into [redacted]lity, which is always a dangerous proceeding.

[redacted]upati case some sanitary improvement had taken place in conservancy, water, and food. [redacted]ot the cholera history as yet of October 1883, so that no connexion can be traced with [redacted] epidemic history, if any such existed; but with the facts about Upper Tirupati during [redacted] cholera outbreak there, we think it doubtful whether every disease cause then brought [redacted]d been removed.

[redacted]irs the sanitary arrangements are stated to have been sufficient. In the remaining cases [redacted]ty was required. In the same way the water-supply at 19 fairs is favourably reported on, [redacted]remaining cases not so.

The practical result of the year's experience has been that cholera was a very unimportant element in the health history of these fairs, and this great improvement is only a continuation of the annual record of these festivals since sanitary work was first relied on for protection from cholera amongst the people assembled at them. Much good work appears to have been done in the way of prevention, but, on the other hand, we have no information about the outside history of cholera, except in one or two cases.

The lesson *taught* by these reports is the same as the one we have endeavoured to enforce from the experience of previous years, namely, that the only known *method* of protecting festivals and fairs from cholera is systematic preparation of the sites to be occupied before the people arrive, and rigid enforcement of cleanliness and protection of water sources during the time of the festivals. Any return to the old negligence in these matters will very soon show itself in the cholera statistics.

3rd September 1884.

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REPORT

ON

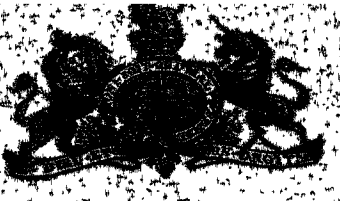
SANITARY MEASURES IN INDIA IN 1883-4;

WITH

MISCELLANEOUS INFORMATION UP TO JUNE 1885.

Vol. XVII.

Presented to both Houses of Parliament by Command of Her Majesty.



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REPORT.

I.—EUROPEAN ARMY OF INDIA.

Sickness and mortality in 1883.

THE health statistics of the European Army in India for 1883 are, as a whole, most satisfactory, and show a further improvement on the favourable results of the previous year. Of an average strength of 55,525, according to the Report of the Sanitary Commissioner with the Government of India, the admissions to hospital in 1883 equalled 1,336 per 1,000 against 1,445 in 1882, the daily sick 63 per 1,000 against 65, and the mortality 10·88 per 1,000 against 12·07. In all respects the results compare favourably with those of the five previous years, while the death-rate was the lowest on record, and fell short of the average of the 10-year period, 1870–79, by 8·46 per 1,000.

The following statement gives the relative extent of the sickness and mortality among European troops in the three Presidencies for 1883, and the previous year:—

Presidency.		Average Strength.	Ratio per 1,000 of Average Strength.		
			Admissions into Hospitals.	Daily Sick.	Deaths.
Bengal	1882	35,164	1,579	69	13·17
	1883	34,079	1,463	66	12·21
Madras	1882	11,020	1,058	57	10·23
	1883	10,498	1,013	59	10·19
Bombay	1882	11,085	1,405	61	10·57
	1883	10,948	1,249	57	10·50
India	1882	57,269	1,445	65	12·07
	1883	55,525	1,336	63	10·88

It will be seen from the above that there was a marked improvement in the health of the Bengal army. The mortality was lowest in the Madras army, and was almost identical with that of 1880 (10·18), the lowest on record. In the Bombay army there was less sickness, with a trifling increase in mortality, which was entirely due to cholera; deducting the deaths from this disease the death-rate for 1883 would stand at 9·68 against 9·74 in 1882. "The facts taken, as a whole," the Army Sanitary Commission observe, "appear "to justify an expression of opinion, that improved health is due to sanitary work at the "stations, and to better habits among the men, and improved administration generally."

Malarial fevers as usual were the chief causes of sickness in the European army, though the admissions were not so numerous as in 1882. The decrease was most marked in Bengal where the ratio per 1,000 of strength fell from 660 in 1882 to 486; in the Madras army the admission-rate under this head was 128 per 1,000 against 171 in 1882; and in the Bombay army 436 against 558. Enteric fever was again the most fatal disease in all three Presidencies, and for the entire European army the death-rate from this cause was 3·40 per 1,000 of strength.

Of the six geographical groups into which the Bengal Presidency has been divided, four recorded a higher admission-rate than the average rate of the Presidency. These were the Punjab group, 1,601; Meerut and Rohilcund, 1,528; Agra and Central India, 1,497; and the Gangetic Provinces and Oudh, 1,474. In the other two groups, the Hill stations recorded the unusually high rate of 1,454, and Bengal Proper, 1,011. Of the various diseases, fevers were most prevalent in the Punjab and Rohilcund with Meerut; dysentery and diarrhœa in Hill stations and Gangetic Provinces; respiratory diseases in Hill stations, Punjab, and Gangetic Provinces; and venereal diseases in Bengal Proper. As regards mortality, the highest ratio, 17·04, was recorded in the Gangetic Provinces, of which 3·92 was due to cholera and 3·17 to enteric fever; Agra and Central India followed with a death-rate of 14·27, enteric fever accounting for 4·26. But although the mortality in both these groups exceeded that of the other four, which ranged from 6·33 to 11·21 per 1,000, the ratios were lower than they had been in many previous years.

Among individual stations of the three Presidencies the average admission-rate for the whole army of India was exceeded in 39, Attock recording the highest, 3,390 per 1,000. Excluding this and other small stations with an average strength of less than 200 men, five stations recorded admission-rates of over 2,000, ranging from 3,032 per 1,000 in Amritsar to 2,563 in

Peshawar. The average mortality of the army of India was exceeded in 38 stations out of 92; and of those with an average strength exceeding 200 the highest death-rates were recorded at the following stations:—Benares 39·89 per 1,000, Gwalior Fort 34·97, Dinapore 26·82, Delhi 24·94, Shahjahanpur 23·81, and Kamptee 23·33. In Benares, Delhi, and Shahjahanpur there were no special causes to account for the high mortality; but in Gwalior 8 of the total 15 deaths were due to enteric fever, and 5 to cholera; in Dinapore 7 of the total 25 deaths were from cholera, and 7 from enteric fever; and in Kamptee 5 out of 14 deaths were from enteric and 3 from cholera.

The statistics of the Rajputana, Malwa, Sind, and Aden group of stations, belonging to the Bombay Command, were very favourable. Of an average strength of 4,687 the admissions were in the ratio of 1,502 per 1,000 against 1,745 in 1882, and the death-rate was 8·32 against 12·37. Mhow, which is the largest station of this group, was not so healthy as in 1882, the admission-rate having increased from 1,602 to 1,822 per 1,000, and the death-rate from 6·67 to 8·07. But the highest death-rates were recorded at the two stations of Indore and Karachi with Ghizree, viz., 17·39 and 16·34 respectively.

In the Deccan and Nagpur group of stations, also under the Bombay Command, the health of the European troops (average strength 6,694) in 1883 was not, on the whole, so satisfactory as in the previous year. The admissions declined from 1,029 per 1,000 in 1882 to 1,001, but the mortality rose from 7·94 to 10·72 per 1,000. Of the total admissions 265 per 1,000 were due to venereal diseases, while enteric fever and cholera were the chief causes of mortality, contributing 2·72 and 1·72 respectively to the total death-rate. This group comprises 11 stations, five of which recorded admission-rates exceeding the average; but at the two largest stations, Poona and Secunderabad, both sickness and mortality were much below the average rate of the group; the former yielded a death-rate of 8·33 per 1,000, and the latter 7·36. The highest mortality at any single station was 24·00 at Asirgarh, Kamptee following with 23·33, Kolhapur with 22·99, and Satara with 20·98. Excepting Kamptee, which had an average strength of 600, the other stations are all small, and a few deaths account for the large ratios.

In the seven stations comprising the Southern India group, with an average strength of 4,661, the admission-rate was 1,126, or 7 per 1,000 higher than in 1882; the death-rate was also slightly in excess of that of the previous year, 8·58 against 8·30. In this group also venereal diseases were the chief causes of admission (339 per 1,000), and wounds and accidents gave rise to a ratio of 128. More than half the mortality was due to enteric fever and hepatitis, the former yielding a death-rate of 3·44 and the latter of 1·72. Four of the stations recorded admission-rates of over 1,000; Bangalore, which is the largest station of the group, came first with 1,356 per 1,000; it also recorded the highest death-rate, viz., 11·53, which was almost identical with its average rate of 11·81 for the last decade. The next highest death-rates were 7·79 in Madras, 7·27 in Cannanore, and 7·11 at Bellary, all being considerably below the averages, especially Madras and Cannanore.

The statistics of the Burma and Pegu group of stations, four in number, compare favourably with those of the previous year. Of an average strength of 2,001 the admission-rate was 980 per 1,000 against 1,047 in 1882, and the mortality was 10 per 1,000 against 11·20. There were no deaths from cholera in this group; hepatitis was the chief death cause, contributing 2·50 of the total death-rate, dysentery and injuries following with death-rates of 1·00 per 1,000 each. Rangoon is the largest station in this group, and recorded the highest admission-rate of 1,304 per 1,000, towards which venereal diseases contributed 266, fevers 151, and dysentery and hepatitis 106 each. There were eight deaths in this station, equal to 10·91 per 1,000 of strength, half of which was due to hepatitis. Port Blair, a small station with an average strength of 140, recorded the highest death-rate (14·29); but only two deaths gave rise to this ratio.

The Hill stations of Madras and Bombay had an average strength of 811 men, among whom the admissions to hospital equalled 1,059 per 1,000 and the deaths 8·63, both being lower than in the previous year, and considerably below the average of the decade 1870–79.

Cholera.

As in the previous year there was very little cholera among the European troops in 1883, and the mortality it occasioned was pretty equally distributed over the three Presidency armies. In the army, as a whole, there were only 82 cases, and of these 51 or 0·92 per 1,000 of strength proved fatal. In 1882 there were 98 cases and 61 deaths or 1·07 per 1,000. Of the cases under treatment in 1883, the percentage of mortality was 62·20 against 62·24 in 1882. These favourable results were mainly due to the diminution of the disease in the Bengal portion of the army, in which there were 48 cases and 32 deaths, or 0·94 per 1,000 of strength against 73 cases and 45 deaths or 1·28 in 1882. In the Madras army the cholera deaths numbered 10 or 0·95 per 1,000 against 9 or 0·82 in 1882; and in the

Bombay army there were 9 deaths or 0·82 per 1,000 against 7 or 0·63 in 1882. Compared with the average death-rates of the ten-year period 1870–79 the cholera mortality among the Bengal troops in 1883 was 3·24 per 1,000 less; among the Madras troops it was 0·73 lower, and among the Bombay troops 0·71 less. Of the six groups of stations in Bengal the disease was confined really to two, the Gangetic Provinces and Agra and Central India groups, which recorded 39 cases with 26 deaths and 6 cases with 5 deaths respectively. Three of the remaining four groups were exempt, while there was only one case in Bengal Proper which proved fatal. The whole cholera mortality of the year took place in 15 stations, while more than a half of the total deaths were recorded in six stations belonging to the Gangetic Provinces and Oudh group.

Small-pox.

There was a greater prevalence of small-pox than usual in the Bengal army. The total cases numbered 105 against 44 in 1882 and 9 deaths against 4. The increase mainly occurred in the Bengal group of stations where 86 cases were admitted into hospital, the largest number of any year since 1870, and 7 deaths, equal to a ratio of 0·21 per 1,000 of strength. The Madras and Bombay armies recorded one death each.

Fevers.

From intermittent fevers the admission-rate for the whole army fell from 494 per 1,000 in 1882 to 359 in 1883, and the death-rate from 0·07 to 0·05, all three Presidencies sharing in the diminution. Under remittent and continued fevers there were also fewer admissions, the rate having declined from 53 per 1,000 in 1882 to 49 in 1883. Enteric fever showed an increased admission-rate in 1883 with a lower death-rate. Throughout the whole European army there were 429 admissions or 7·7 per 1,000 of strength against 357 or 6·2 in 1882, while the deaths numbered 133 or 2·40 per 1,000 against 146 or 2·55. Of the three armies enteric fever was most prevalent in that of Madras, which recorded an admission-rate of 8·6 per 1,000, more than double its ratio of 1882, and a death-rate of 2·86 against 2·09. The severity of the disease among the Madras troops was, however, much less than in the previous year, as is shown by the fact that while in 1883, 33⅓ per cent. of those attacked died, the percentage in 1882 was 52·27. Among the Bengal troops the admission-rate rose from 7·3 per 1,000 in 1882 to 8·1 in 1883, while the mortality declined from 2·90 to 2·52. In the Bombay army also the admissions rose from 5·1 per 1,000 in the previous year to 5·7 in 1883; but the death-rate fell from 1·98 to 1·55. As regards the relationship between enteric fever and age, the statistics for 1883 show that 41 per cent. of the strength of the entire army was under 25 years of age, and that among them the death-rate from this cause was 4·34 per 1,000, whilst among men between 25 and 29 years of age, forming 35 per cent. of the army, the mortality was only 1·50 per 1,000. The susceptibility of young soldiers to this fever is also clearly shown in the length of residence in India, for while the death-rate from this fever of those in their first and second years' service was 4·98 per 1,000, among those in their third to sixth years and seventh to tenth years it was 1·55 and 0·55 per 1,000 respectively. The experience of newly arrived regiments in 1883 (*see* below) also witnesses to the influence of climate in the production of enteric fever, no less than 8·95 of the total death-rate (19·96) of these regiments being due to this disease. Additional evidence of the influence of youth and short residence to this fever is afforded by the statistics of individual stations. At Lucknow, for example, out of 44 cases, 35 of which took place in one regiment composed principally of young soldiers, 33 occurred among men between 20 and 24 years of age and of less than one year's residence in India. The source of the disease, it is stated, could not be ascertained. "The sanitary condition of the barracks and surroundings was "excellent, and in the barracks occupied by the regiment which supplied most of the cases "there was no marked prevalence in any one building or locality."

Venereal diseases.

Venereal diseases were even more common in the European army in 1883 than in the previous year, the admission-rate having risen from 265 per 1,000 of average strength to 270. Of the three Presidency armies, the results of those of Bengal and Madras were the most unfavourable, each showing a slight increase, while in the Bombay army the admission-rate fell from 224 per 1,000 in 1882 to 218 in 1883. In his Report for 1883, Dr. Cunningham compares the statistics of those stations in which the lock hospital system prevailed with those of unprotected stations. In the 14 years ending 1883, the average admission-rate for the whole army in protected stations was 223 per 1,000, while in unprotected stations it was only 3 per 1,000 higher. This small difference in favour of protected stations was entirely due to the favourable results of Bombay, for both in the Bengal and Madras armies the average admission-rates for the 14 years in the protected stations exceeded those in unprotected stations. In 8 of the 14 years the protected stations recorded a smaller proportion of admissions than the unprotected stations, the greatest difference being in the

year under notice, when the rate for the former was 271 per 1,000, and that of the latter 341, or just 70 per 1,000 greater. Of the six years in which the admissions in protected stations exceeded those of unprotected stations, the greatest excess was 33·2 per 1,000 in 1872. It will thus be seen, as Dr. Cuningham observes, that "the diminution of venereal diseases in "protected stations for the army as a whole is quite insignificant."

Invaliding.

The number of men invalided during 1883 was 1,811, or in the proportion of 32·66 per 1,000 of average strength, which is less than the rate of the previous year by 0·42, and also lower than the average of the ten years 1870–79 by 10·38 per 1,000. With the exception of 1880, when the invaliding-rate was 26·31 per 1,000, that of 1883 is the lowest on record since 1870. The distribution of invaliding in the three Presidencies was not so disproportionate as in previous years. In Bombay, which contributed the largest share, the invaliding rate for 1883 was 38·08 per 1,000 against 35·85 in 1882, and 42·79 the average of the decade 1870–79. In Madras the loss from invaliding was in the proportion of 32·70 per 1,000 against 24·12 in 1882 and a decennial average of 48·71. In Bengal the invaliding rate was lowest, namely, 30·89 or 4 per 1,000 less than in 1882 and against an average 10 years' rate of 41·40. Of the total 1,811 men invalided during the year under review, 702 or 39 per cent. were for discharge from the service, and this average percentage was made up of 45 in Bengal, 40 in Madras, and 31 in Bombay. The principal diseases necessitating invaliding were anæmia and debility, phthisis pulmonalis, hepatitis, and diseases of the heart and arteries. For the army as a whole, 36·55 per cent. of those invalided were under 25 years of age as compared with 31·82 in 1882 and 33·74 in 1881. The effect of residence in India upon invaliding is shown by 18·94 per cent. of the total having been less than two years in the country, and by 57·81 per cent. having served from two to five years.

In their memorandum on Dr. Cuningham's report (see Appendix, p. 143), the Army Sanitary Commission call attention to the improvement which has taken place in the health statistics of the European army of India since 1859 when the Royal Commission began its inquiry. They say: "In estimating the possible saving of army life, the Royal Commission "considered that the death-rate of 20 per 1,000 ruling among Indian civil servants "ought to be attainable for soldiers by the application of ordinary sanitary methods. But "they went beyond data of this class, and drew pointed attention to sanitary work which "must in time be done, while they expressed a hope that when the stations and their "vicinity were brought under proper sanitary regulation 'the natural death-rate in times of "'peace of men of the soldiers' ages in India will be no more than 10 per 1,000 per "'annum.' We have already shown how the death-rates have been falling under sanitary "work in years of peace, and how they are temporarily raised in war years. But we have "now arrived at this point, that up to the time of the Royal Commission of 1859 the station "death-rates in India had been on an average 69 and 70 per 1,000, while in 1883 the rate "was 10·88 per 1,000 for the whole Indian army."

Health of newly arrived regiments.

The health statistics of newly-arrived regiments as compared with those of the army generally were less favourable than they were in 1882. The average strength was less than one-half of that of the previous year, 1,453 against 3,344, and amongst this number the admission-rate was 1,738 per 1,000, or 402 per 1,000 greater than the general rate of the army as a whole; the daily sick-rate was 82·6, or 19·7 higher; and the death-rate was 19·96, being 9·08 per 1,000 in excess of the general mortality. Compared also with the results of 1882 the health of newly-arrived regiments was far less satisfactory in 1883. From enteric fever the death-rate among newly-arrived troops was 8·95 per 1,000, over 6½ per 1,000 higher than the rate for the whole army, and 1·77 in excess of the mortality from this cause in 1882. "It is clear," the Army Sanitary Commission remark, "that large arrivals of men "new to Indian service must exercise a notable influence on the death-rates, and hence, "when there are few new regiments sent out, the general army rate will be lower than it "would be otherwise."

II.—NATIVE ARMY.

The mean strength of the Native Army of India in 1883 was 114,830, identically the same as in the previous year, and the health of these troops was on the whole very favourable. Both sickness and mortality were less than in any year since 1877 when the statistics for the whole army of India were for the first time combined. The admissions into hospital were in the ratio of 923 per 1,000 against 1,129 in 1882; the daily sick 31, or 6 per 1,000 less, and the deaths from all causes 11·76 per 1,000 against 12·24, or 14·31 including men absent from their regiments against 14·76. Sickness and mortality in 1883.

The following are the main facts regarding the sickness and mortality of the various portions of the Native Army:—

	Average Strength.	Ratio per 1,000.			
		Admissions.	Daily Sick.	Deaths.	Total Deaths, including Absentees.
Bengal Native Army	40,932	985	32	10·55	13·98
Madras ditto	27,703	782	27	12·76	17·51
Bombay ditto	23,576	994	35	12·82	14·96
Central India Regiments	5,197	595	19	7·89	10·16
Punjab Frontier Field Force	10,438	1,419	45	22·46	28·35
Hyderabad Contingent	6,983	572	20	7·59	9·31
India as a whole	114,830	923	31	11·76	14·31

In the Bengal Native Army, both sickness and mortality show a great diminution compared with the previous year, the admission-rate having declined from 1,250 in 1882 to 985 per 1,000, the daily sick-rate from 41 to 32, and the mortality from 13·34 to 10·55, or including absent deaths from 16·49 to 13·98. From nearly all diseases there was less sickness than in 1882, and where there was any increase it was very trivial. Intermittent fevers showed the most striking reduction, from 606 per 1,000 in 1882 to 396. As regards mortality the only diseases which showed a higher ratio were phthisis and small-pox, the latter being unusually prevalent during the year. The cases rose from 21 in 1882 to 50 or 1·2 per 1,000 of strength in 1883, and the number of deaths from 5 to 12. From respiratory diseases the death-rate continued to decline; during the year under notice it was 3·20 per 1,000 against 4·50 in 1882 and 6·59 in 1881. From cholera there were only 38 cases with 23 deaths, or 0·56 per 1,000 of strength against 0·72 in 1882. Enteric fever gave rise to 12 admissions, 3 of which ended fatally, as against 11 cases and 7 deaths in the previous year, apparently showing that the cases in 1883 must have been comparatively mild. Bengal Army.

The following is a statement of the health of the troops in the several geographical groups of the Bengal army:—

	Ratio per 1,000.		
	Admissions.	Daily Sick.	Deaths.
Bengal Proper and Assam	1,408	46	16·23
Gangetic Provinces	920	34	8·17
Rohilcund and Meerut	978	36	11·53
Agra and Central India	906	30	5·77
Punjab	830	45	10·80

As was the case in the two previous years, Agra and Central India on the whole recorded the most favourable results, though in 1883 the Punjab group had the lowest admission-rate. In the Bengal Proper and Assam group, as usual, sickness and mortality were higher than in any other group, but both rates were the lowest on record, the death-rate being nearly 3 per 1,000 below the average. The diminution of mortality was most marked in the Agra and Central India and Punjab groups; in the former group the death-rate was 1·41 per 1,000 less than in 1882 and 3·84 below the average, and in the latter group it was 2·50 per 1,000 less than the rate of 1882 and 3·44 lower than the average. In all groups the admission-rate was less than in 1882, and the only group which recorded a higher mortality was Rohilcund and Meerut, viz., 1·55 per 1,000, but the average rate was exceeded by only 0·34 per 1,000. Fevers, as usual, were the chief causes of admission in each of the groups,

but they were much less prevalent as compared with 1882; the most marked cases were the Agra and Central India and Punjab groups where the fever admission-rates were nearly half those of the preceding year. Bowel complaints were also less prevalent than in 1882, and below the average; respiratory diseases caused fewer admissions in all groups, but only in the Punjab group was the diminution at all marked.

As regards the chief death causes in the different groups, cholera gave rise to the highest mortality in the Lower Bengal and Assam group, where it equalled 1·80 per 1,000 against 3·01 in 1882. The next highest death-rate from this disease was 1·17 in the Gangetic Provinces and Oudh group against 0·85 in 1882. In the Agra and Central India group there were no deaths from cholera, and in the other two groups the mortality was small. The fever death-rates ranged from 2·46 per 1,000 in Lower Bengal and Assam to 0·79 in the Punjab, the latter showing a great reduction on 2·11 in 1882. Bowel complaints were also more fatal in Lower Bengal and Assam (3·28 per 1,000), whilst in the Gangetic Provinces the ratio was only 0·26. In all the groups the mortality from respiratory diseases was less than in 1882, though, except in Agra and Central India, it exceeded the average of the ten-year period 1867–76; from these diseases the death-rate varied from 4·97 per 1,000 in the Punjab to 1·59 in Agra and Central India.

In individual stations the maximum admission-rate was recorded at Edwardesabad and outposts, where it equalled 2,217 per 1,000, or 80 less than in 1882. In seven other stations the admission-rates varied between 1,500 and 2,000, while in the previous year six stations had admission-rates exceeding 2,000, and 15 stations between 1,500 and 2,000. Edwardesabad and outposts also recorded the highest mortality (39·19 per 1,000), and here respiratory diseases were the chief causes contributing no less than 59 of the total 70 deaths. In six other stations (seven in all) the mortality was above 20 per 1,000. For seven months of the year a small force of 624 Bengal troops was on service in Southern Afghanistan; the mortality during occupation was only 3·21 per 1,000 against a ratio of 36·10 during a three months occupation in 1882, and of 106·30 for the year 1881. There were only two deaths in 1883, one in hospital and one out of hospital, the former having resulted from respiratory disease. The admissions into hospital were in the ratio of 910 per 1,000.

Among the 10,438 troops comprising the Punjab Frontier force there was considerably less sickness in 1883 than in the previous year, but an increased mortality. The admission-rate fell from 1,992 in 1882 to 1,419, the daily sick-rate from 60 to 45, while the mortality was 21·46 or 5·52 per 1,000 higher, and including absent deaths, 23·35 against 18·89. Out of the total 224 deaths in this force 148, or 14·18 per 1,000 of strength, were due to respiratory diseases, the majority (104) having taken place at the two stations of Kohat and Edwardesabad with their outposts.

The health statistics of the Central India regiments during 1883 were extremely favourable. Of an average strength of 5,197 the admissions into hospital equalled 595 per 1,000 against 697 in 1882, the daily sick 19 per 1,000 against 23, and the mortality 7·89 or 2·07 per 1,000 less; but including absent deaths the rate was nearly the same, 10·16 against 10·58. The chief death-causes among these troops were fevers, chiefly remittent and continued, which occasioned 11 of the total 41 deaths, or 2·12 per 1,000, respiratory diseases following with 7 or 1·35. From cholera there were two fatal cases.

As usual the Hyderabad contingent was the most healthy body of Native troops. There was less sickness among them than in any year since 1877; but the mortality, which was 7·59 per 1,000, exceeded the ratio of 1882 by 4·47; this was due mainly to cholera, which gave rise to 15 of the total 53 deaths, or 2·15 per 1,000 against a ratio of 0·29 in 1882; respiratory diseases and anæmia and debility followed with 8 deaths each, or 1·15 per 1,000.

Madras Native Army.

The Madras Native Army was, on the whole, more healthy in 1883 than in any of the previous six years. The admission-rate per 1,000 of an average strength of 27,703 was 737, against 879 in 1882, the daily sick-rate 27, or 3 per 1,000 less, and the death-rate 10·76 against 12·01, or including absent deaths 12·51 against 14·99. Intermittent fevers stand first as causes of admission being over a third of the total, while cholera occasioned the greatest number of deaths. Out of a total of 298 deaths, 81 or 2·92 per 1,000 of average strength, were due to this disease, which, however, was little in excess of the mortality of 1882, when there were 73 deaths, or 2·64 per 1,000. Of the remaining deaths 46, or 1·66 per 1,000, were due to respiratory diseases, 21 or 0·76 to anæmia and debility, and 20 or 0·72 to dropsy. Among the Madras troops serving in Hyderabad and Nagpur the health statistics were not so favourable as in 1882; sickness was slightly more prevalent, and the death-rate rose from 11·58 to 18·50 per 1,000. On the other hand there was a great improvement in the health of the troops serving in the northern division of the Madras army, the admission-rate having fallen from 1,559 to 710, the daily sick from 44 to 27, and the death-rate from 13·97 to

7·93 per 1,000. There was also a satisfactory improvement in the health of the troops stationed in Southern India, and in Burma and the Andamans.

Bombay Native Army.

The statistics of the Bombay Native Army in 1883 were on the whole much the same as in the previous year. Out of an average strength of 23,576 the admissions in 1883 equalled 994 per 1,000 against 1,067 in 1882, the daily sick 35 per 1,000 or one less, and the death-rate 12·81 or 0·65 per 1,000 higher; including absent deaths the mortality was 14·96 per 1,000 against 13·41 in 1882.

Of the chief diseases there were only 21 cases of cholera with 11 deaths; from small-pox 104 cases were recorded against 25 in 1882, but only two proved fatal; bowel complaints were also more prevalent, while other diseases showed a decline. Respiratory diseases gave rise to the greatest number of deaths—109, or 4·62 per 1,000 out of a total of 302 from all causes; remittent and continued fevers followed with 36 deaths, and dysentery and diarrhœa with 22 deaths. Of the various portions of the Bombay army the force serving in Southern Afghanistan was the most unhealthy. Among this force of an average strength of 3,959 the admission-rate was 1,741 per 1,000, the daily sick 56, both being below the ratios of the previous year; but the death-rate rose from 35·80 to 37·64. Of the total 149 deaths, 74 or 18·69 per 1,000 of strength, were due to respiratory diseases, 15 to remittent and continued fevers, and 15 to dysentery and diarrhœa. This portion of the Bombay army was exempt from cholera. The Northern division of the Bombay army comes next in order of sickness with an admission-rate of 956, and a daily sick-rate of 33 per 1,000, both ratios being slightly in excess of those of 1882; while the death-rate fell from 7·78 in 1882 to 5·47. In the other three divisions of Aden and Sind, Konkan, and Kandeish the admission-rates were under 800 per 1,000, and the death-rates were 13·91, 9·74, and 5·33 respectively against 7·19, 11·17, and 6·26 in the previous year. Amongst individual stations the highest death-rates were recorded in Hyderabad, 19·23; Surat, 12·24; and Kaladgi, 12·05.

The Aka expedition.

During the year a small expedition, consisting entirely of Native troops, was organised against the Akas, a tribe of hill-men whose territory lies to the north of Tezpur on the Brahmaputra. This force consisted of 30 officers, 1,026 men, and 1,993 followers, and it crossed the frontier on the 17th December 1883. The disturbance was soon quelled, and the troops began to return on the 21st January 1884, and by the 1st February they were nearly all back at Tezpur. The medical history of this expedition shows that both among troops and followers serious disability and loss of service resulted from the bite of the pipsee fly, a small insect which is very numerous in the Aka country. The troops suffered more from ague and dysentery than from any other disease, while the followers suffered, in addition, considerably from respiratory diseases and diarrhœa. The mortality among the troops consisted of one case of pneumonia only; while among the followers there were in all 16 deaths, 10 of which resulted from respiratory diseases.

III.—GENERAL POPULATION.

The following statement exhibits the registered deaths from the four principal diseases and from all causes in the different provinces of India during 1883 :—

	Cholera.		Small-pox.		Fevers.		Bowel Complaints.		Deaths from all Causes.		
	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000 of Population under registration. 1883.	1882.
Bengal, excluding Calcutta	90,439	1·36	9,714	0·14	913,766	13·81	55,270	0·83	1,245,676	18·82	20·41
Calcutta	2,037	4·70	73	0·16	3,442	7·94	1,307	3·01	12,325	28·44	30·40
Madras	36,784	1·27	37,975	1·33	203,786	7·04	22,008	0·77	541,930	18·98	16·29
Bombay	37,954	2·31	13,104	0·81	266,741	16·21	35,292	2·14	420,108	25·53	20·87
Punjab	190	0·01	12,103	0·64	306,185	16·25	14,607	0·77	475,741	25·25	26·79
North-Western Provinces and Oudh	13,160	0·41	133,641	3·14	830,258	18·32	66,530	1·50	1,216,297	27·57	33·67
Central Provinces	16,235	1·84	4,696	0·53	175,119	19·86	26,623	3·02	304,763	34·56	29·98
Berar	27,297	10·60	3,853	1·46	53,593	20·37	19,044	7·24	135,081	51·36	29·35
Assam	14,968	3·29	6,162	1·36	67,494	14·90	14,474	3·19	122,932	27·14	25·85
British Burma	2,185	0·60	675	0·18	26,283	7·19	2,781	0·76	53,583	14·67	16·14
Mysore	124	0·03	4,840	1·16	33,139	7·92	4,781	1·14	63,243	15·11	16·93
Coorg	—	—	300	1·68	3,295	18·49	123	0·70	3,879	21·75	17·46
Total	246,413	1·24	232,436	1·12	2,883,101	14·55	263,030	1·32	4,595,648	23·20	23·91

Bengal.

Special measures were taken during 1883 with the view of securing greater accuracy in the registration of vital statistics in Bengal, the results for the year, however, do not show any improvement. Birth registration was carried on only in 46 towns, or one more than in the previous year, and their mean birth-rate equalled 22·08 per 1,000 of population against 22·65 in 1882. The defectiveness of the system of registration may be judged from the fact that the town birth-rates varied from 6·40 in Darjeeling to 49·17 in Jamalpore.

The year 1883 in Bengal was a comparatively healthy one, though unfavourable from an agricultural point of view, the rainfall having been deficient and irregular, and 8·11 inches below the average, causing a failure of the crops and much privation among the poorer classes. Still the registered deaths were fewer by 103,975, the total numbering 1,245,676 or 18·82 per 1,000 against 1,349,651 or 20·41 in 1882. The imperfectness of registration is further shown in the great differences of the district death-rates which ranged from 9·93 per 1,000 in Monghyr to 36·07 in Nuddea. Amongst the rural population the mortality was 18·49 per 1,000, while that of the towns was 27·28, the last being a mean of ratios varying from 9·56 in Sudharam to 46·97 in Gya.

Of the chief diseases contributing to the year's mortality, cholera was considerably less prevalent than in 1883, the deaths having fallen from 182,352, or 2·75 per 1,000 in 1882, to 90,439 or 1·36. All the districts were affected, but the entire mortality was returned from less than 7 per cent. of the total 248,751 villages. The disease prevailed most severely in Nuddea and Julpigoree districts, which recorded death-rates of 4·69 and 4·17 per 1,000 respectively; in four other districts the ratios ranged from 3·73 to 3·00, and in five from 2·40 to 1·95; but while 11 districts suffered conspicuously from cholera in the year under notice, 28 of the total 45 districts recorded death-rates ranging from 1·96 to 6·20 in 1882. The disease was most severe in the dry and hot months of April, May, and June, and, as usual, subsided during the rains. With very few exceptions the fairs held in the province during the year were exempt from cholera, although in several of them, it is reported, no sanitary precautions were adopted to prevent its incidence. "The practical result of the "cholera experience in Bengal during 1883," the Army Sanitary Commission state, "confirms that of all previous years. We know nothing of the real disease cause. This "varies in intensity, so far as can be estimated by the death-rates in different years and in "different localities, and the conditions which appear to affect the local mortality most "markedly are those which may all be classed under the head of defective sanitation, such as "filth, bad water, crowding of dwellings and villages, permanently and temporarily, by influx "of pilgrims or other passengers, and these causes of augmented local mortality point to the "required remedies."

The mortality from small-pox in 1883 was lower than that of any year in the preceding decade, excepting 1875 and 1877. There were 9,714 deaths, or 0·14 per 1,000 of population, against 13,651 or 0·20 in the previous year. Bogra was the only district in Bengal which enjoyed complete immunity from the disease. The incidence of the disease was marked during the year with more or less severity in 80 circles of registration against 33 in 1882, and it was absent from 284 against 280, and affected 1·73 per cent. of the villages against 2·33 per cent. in the previous year. Of the total deaths 1,383 took place among children under one year of age, and more than a half, or 5,018, among children between one and 12 years.

Fevers prevailed with diminished severity during 1883 as compared with the previous year. The deaths numbered 913,766, or 13·81 per 1,000 of population, against 929,943 or 14·06 in 1882, showing a decrease in the year under notice of 16,177. Of the 45 districts, 19 returned enhanced mortality against 22 in the previous year; and fatal cases were returned from 57 per cent. of the villages against 54 per cent. in 1882. Fever mortality varied greatly in the different districts; the highest death-rates were 30·12 in Rajshahye and 27·60 in Nuddea. In the previous year Nuddea and Burdwan were the chief sufferers, but it is satisfactory to learn that in both these districts fevers were diminishing. The Army Sanitary Commission instance a number of cases showing the local fever causes in 1883. The main causes of fever mortality, they say, are purely local, and are connected with the drainage defects and marshy condition of defined areas which surround towns and villages. The Commission urge that "it should be kept in view, as an axiom of sanitary work in "India, that disease causes are chiefly to be found in the dwelling itself and its immediate "surroundings."

Deaths from bowel complaints, which the Sanitary Commissioner considers to be enormously under-registered, amounted to 55,270 or 0·83 per 1,000 against 61,382 or 0·92 in 1882, showing a decrease of 6,112. The year's mortality is reported to have occurred in 9 per cent. of the villages as compared with 10 per cent. in 1882.

In the city of Calcutta there was an improvement in the public health as compared with the previous year, though cholera again prevailed very extensively. From all causes 12,325 deaths were registered, equal to 28·44 per 1,000 of population, against 13,177 or 30·4 in 1882. From cholera 2,037 deaths were reported or 4·70 per 1,000, being within a fraction of the abnormal mortality of the previous year. Fevers continued to show a steady decrease; the deaths fell from 3,818 or 8·80 per 1,000, to 3,443 or 7·94; there was also a marked decrease in the mortality from bowel complaints; but small-pox deaths rose from 17 to 73.

Madras.

Although in the Madras Presidency the year 1883 was one of fair average rainfall and the prices of food grains remained low, it was not, on the whole, a healthy year. The vital statistics for the Presidency show that 791,774 births were registered during the year, equal to 27·7 per 1,000 of population, the highest ratio which has yet been reached, against 751,104 or 26·0 in 1882. The district birth-rates varied from 13·7 in the Nilgiris to 40·9 in Madras. In 12 out of 22 districts the average rate was exceeded, and in only one district (Malabar) the birth-rate was less than the mortality. With the increase in the births there was also a considerable rise in the deaths, which numbered 541,993, or 19·0 per 1,000, against 470,700 or 16·2 in 1882, showing an increase of 71,230. But this excess in the death-rate is more apparent than real, and is due in a great measure to the fact that for the first time the census figures of 1881 were utilised in computing the statistics, which differed from those on which the statistics for 1882 had been based by more than a third of a million less.

Under every head of disease there was an increase in mortality. Cholera was considerably more prevalent than in any year since the famine year 1877. The deaths numbered 36,284 or 1·27 per 1,000 of population against 23,604 or 0·81 in 1882. The three districts of Vizagapatam, Kurnool, and South Canara were exempt from the disease, and in the districts of Godavari, Kistna, and Nilgiris it prevailed but slightly. Cholera was most severe in South Arcot, Trichinopoly, Tanjore, Tinnevelly, and Madura, which together yielded slightly over two-thirds of the total mortality. The disease was much more severe in the towns than among the rural population, the death-rate of the former being 3·8 per 1,000, and that of the latter 1·1. In some of the towns the mortality was excessive, especially in Gudiyatam (North Arcot) where it reached 34·2 per 1,000 of its population, and in Karur (Coimbatore), where it was 25·2. In discussing the statistical data for this disease, the Army Sanitary Commission notice that the deaths during the nine years ending 1883 were more than double the number in the previous nine years, and even omitting the enormous death-rate of the famine year, 1877, the mortality in the latter period was greater. "It follows as a matter of "course," they say, "that no sanitary work which has been done in the towns and villages

" of Madras Presidency has materially influenced local conditions during the whole 18 years, " taken at least over the entire population. There are exceptional cases which add stronger " proof to the rule that cholera is a test of the health condition of localities in Madras " Presidency, as it is everywhere, for we only know cholera through its manifestations in " localities, and we have as complete proof as can be obtained of what the sanitary condition " of affected towns and villages really is, and this knowledge leads us directly to the practical " remedies required."

Small-pox also was very prevalent, causing more deaths than in any year since 1878, viz., 37,975 or 1·33 per 1,000 against 20,159 or 0·69 in 1882. Every district was affected, those of Madras and Malabar the most severely, which recorded death-rates of 4·9 and 4·3 per 1,000 respectively. Strenuous efforts were made on the part of the Madras municipal authorities to counteract the heavy mortality by the extension of vaccination; "but the poor " people are," the Sanitary Commissioner states, " so firmly wedded to the belief that the " disease is a visitation of the goddess Mariamma, and to be looked upon rather as a beneficent " mark of her favour than any misfortune, that all merely persuasive efforts on the part of " Europeans seem useless to combat the epidemic." Of the total deaths 61·3 per cent. occurred among children under 12 years of age. The registered deaths from small-pox for a period of 13 years show that the disease is by no means an occasional visitant in the Madras Presidency. "In the present state of public opinion on the subject of vaccination," the Army Sanitary Commission observe, "it is not likely that these figures with their recurring " years of aggravations will be materially reduced by the vaccination service; although one " obvious result of the data as a whole is to point clearly to the necessity of concentrating " effort on the vaccination of infants. But when taken in connection with the cholera " mortality they strengthen the conclusion that both epidemics are at present very unneces- " sarily aggravated by the neglect of sanitary measures."

Fever deaths were more numerous than in 1882 by 15,225, the total number being 203,786 or 7·04 per 1,000 against 188,561 or 6·54. District death-rates varied from 1·7 per 1,000 in Tanjore to 14·0 in Kurnool, the next highest were 11·8 in Malabar, 10·9 in Vizagapatam, and 10·0 in Cuddapah. Statistics show, as the Sanitary Commissioner observes, "that it is during the cold and monsoon months that the greatest number of " victims succumb to fevers, that it is more a climatic than a mysterious malarial malady. " When the poor people learn how to protect themselves by proper clothing and food from " rapid changes of temperature, then the muster-roll of deaths from fever will diminish." But the Army Sanitary Commission urge that the prevalence of disease must first be reduced by the sanitary improvement of dwellings and their surroundings. "On this," they say, " there will follow improved stamina and greater ability to work, besides improved habits of " life, and, as a matter of course, there will be better food and better clothing, and these in " their turn will further improve general health."

Deaths from bowel complaints amounted to 22,098 or 0·7 per 1,000, exceeding the number of the previous year by 2,140. The highest district death-rate was 5·6 per 1,000 in Madras, followed by 2·4 in South Canara; in four other districts the mortality was over 1 per 1,000.

The health of Madras city in 1883 was not so good as in the previous year, the deaths having risen from 14,169 or 35·6 per 1,000 to 15,882 or 39·8. This increase was entirely due to the unusual severity of small-pox, from which there were 1,957 fatal cases, being 1,602 over the number of 1882; bowel complaints also were more prevalent, but cholera deaths declined from 461 to 169, and fever deaths from 3,706 to 3,470.

Bombay.

In the Bombay Presidency the year 1883 was an unhealthy one; the rainfall was unusually heavy in some districts, and at one season of the year fears were entertained of scarcity over extensive areas of the Deccan and the Konkan, owing to a pestilence of locusts. The energetic measures, however, which were taken by order of the Government for their destruction in the affected districts were attended with success, whilst the strong easterly wind which set in after the rains, blew great numbers of them into the sea.

The number of births registered during the year was 501,891 or 30·50 per 1,000 of population against 491,346 or 29·86 in 1882. In each of the five divisions of the Presidency, except the Konkan, more births were registered than in the previous year. Registration still continues very backward in the Konkan and in Sind, especially the latter, which recorded a birth-rate of only 18·62 per 1,000; but on the whole the district ratios show that the average was fairly maintained over the Presidency. The registered deaths exceeded the number of the previous year by 76,780, the total being 420,198 or 25·53 per 1,000 against 343,418 or 20·87 in 1882. The year's death-rate was made up of extremes, varying from 9·19 per 1,000 in Upper Sind frontier to 41·97 in Kandesh. The increase was pretty general, for 17 districts out of a total of 24 recorded higher death-rates than in 1882. Amongst children under five years of age the mortality was again very high, being in the proportion of 40·54 per cent. of the total deaths.

From all the chief diseases the mortality was much heavier than in the previous year. The Army Sanitary Commission notice that the excess of epidemic deaths in 1883 over the average of the 10 previous years was 36,567. "The practical conclusion therefore is," they say, "that there was a great augmentation in epidemic susceptibility among the people in 1883, "a sure proof that sanitary work has not yet reached its causes, and pointing at the same "time clearly to the sanitary measures required, and the urgent necessity of taking them in "hand without delay."

Cholera prevailed with very great severity, causing 37,954 deaths or 2·31 per 1,000 of population against 7,904 or 0·48 in 1882, showing that the mortality of 1883 was nearly five times greater than that of the previous year. The severity of the epidemic was, however, confined chiefly to the North Deccan division, the five districts of which yielded 30,298 of the total cholera deaths, and a death-rate of 7·12 per 1,000, over three times greater than the mortality for the whole Presidency. In the Sind division, also comprising five districts, the disease was entirely absent. Although the mortality from cholera was so unusually large, the number of villages affected by it was only 3,199 or 13 per cent. of the total 24,536; but in the North Deccan division the percentage was 33. At the request of the Local Government the Sanitary Commissioner drew up simple instructions for the guidance of villagers regarding measures to be taken in case of an outbreak of cholera, which, if properly carried out, it is hoped will be the means of saving many lives.

Small-pox also prevailed in an epidemic form more or less throughout the Presidency. The deaths numbered 13,404 or 0·81 per 1,000 against 1,630 or 0·10 in 1882. The only district that was free from the disease was Upper Sind Frontier, while in the others the mortality ranged from 0·06 in Thar and Parkar to 2·18 in Surat. Of the total mortality 33·9 per cent. took place among infants under one year, and 51·9 per cent. among children between 1 and 12 years of age, the remaining 14·2 per cent. being among persons exceeding that age. Statistics show that there is a large number of young children unprotected by vaccination against small-pox, especially in the towns. "I think a general feeling is gaining "ground," the Sanitary Commissioner states, "that the time is fast approaching when it will be "desirable to make vaccination compulsory throughout the Presidency. If it were so, there "is no doubt that the death-rate would in epidemic seasons be considerably lower than it "has hitherto been."

Under fevers, 266,741 deaths were registered, equal to 16·21 per 1,000 of population, exceeding the number of the previous year by 23,287 or 1·41 per 1,000. Of the five divisions the highest ratio (20·70) was recorded in the North Deccan, and the lowest (11·42) in Sind. By districts the highest proportion of fever deaths to population was 24·71 in Kandeish, and the lowest, 7·47, in Bombay City. In the Sind Division the deaths ascribed to fevers formed no less than 86 per cent. of the total deaths from all causes in 1883, against 89 per cent. in the previous year, and 86 per cent. in 1881. "The chief cause," the Acting Deputy Sanitary Commissioner states, "may no doubt be found in flooding of the "country by the River Indus. The inundation of 1882 stands unrivalled. Vast tracts of "land were covered four months with the water which overflowed from the canals. These "districts became very unhealthy, and severe fevers, resulting in a largely increased death-"rate followed. The Shikarpur district was, perhaps, the most severely affected, and "although the death-rate does not compare favourably with that of 1881 (although the "country was free from flooding in 1883), I believe the increase in the number of deaths in "1883 over 1881 must be in a great measure attributed to latent disease induced by the "malarious influences of 1882."

Bowel complaints are reported to have caused the death of 35,292 persons or 2·14 per 1,000 against 28,353 or 1·72 in 1882. As with the other death causes, the North Deccan recorded the highest divisional death-rate, viz., 3·36 per 1,000. The general diffusion of the mortality is shown by the fact that 16 districts out of 24 recorded a higher death-rate than in the previous year. Kandeish, in the North Deccan division, headed the district death-rates with 5·14 per 1,000.

In Bombay City the public health during 1883 was most unsatisfactory, and the number of deaths rose from 20,468 or 25·89 per 1,000 in 1882 to 23,530 or 29·12. Cholera prevailed very extensively, and occasioned 1,027 deaths against 192 in the previous year; the mortality from small-pox also showed a considerable increase, the deaths numbering 1,461 as compared with 92 in 1882. Owing to the alarming increase in the deaths from these two diseases steps have been taken for the provision of hospitals for the special treatment of patients suffering from them. From fevers and bowel complaints there was a very sensible increase, the former causing 5,903 deaths or 450 more than the number recorded in 1882; and the latter 1,806, being 188 in excess of the previous year.

Progress continued to be made in the registration of vital statistics in the Punjab. During 1883 there were 734,912 births registered, equal to 39·90 per 1,000 of population, again

690,524 or 36·65 in 1882. Out of a total of 32 districts, 16 returned birth-rates exceeding 40 per 1,000; in 8 the ratios were over 30 per 1,000; and in the remaining 8 they ranged between 29·68 and 10·04 per 1,000. The general birth-rate was greater than the death-rate by 14 per 1,900, "a result," the Sanitary Commissioner observes, "which speaks very "favourably for the steady improvement of birth registration."

The rainfall of the year was below the average and irregular in distribution, still the harvest was good; the staple articles of food were plentiful, and the public health was, on the whole, favourable. Deaths were registered to the number of 475,741 or 25·25 per 1,000 against 504,799 or 26·79 in 1882.* In 15 districts the mortality was below the provincial rate, ranging from 24 to 16 per 1,000; in the remaining 17 districts the death-rates varied between 25 and 35 per 1,000.

The unusually healthy character of the year is evidenced by the low death-rate from nearly all causes, but more especially from fever and bowel complaints. Cholera in an epidemic form was present only in the Delhi division, where two small outbreaks occurred, which were, however, confined to 25 villages, 5 being situated in the Delhi and 20 in the Gurgaon district. The total number of cholera deaths was 190 against 59 in 1882, and of these the above two districts yielded 180. Out of 54,973 villages the entire mortality was returned from 52.

Small-pox was considerably more prevalent than in the previous year, the fatal cases having increased from 6,379 or 0·34 per 1,000 to 12,105 or 0·64; but its severity was felt only in 11 districts, notably in Karnal, Peshawar, Rohtak, and Gurgaon, which together returned more than half (6,878) of the total mortality. It would appear, however, that a great number of deaths registered under this head were really due to measles. "It has been "reported to me," the Sanitary Commissioner states, "that chaukidars (village watchmen) and "others find it difficult to diagnose one from the other, and in many instances return deaths "from measles as deaths from small-pox." Children as usual were the chief sufferers, as is shown by the fact that 96 per cent. of the deaths occurred among children under 12 years of age. Since the reorganisation of the Vaccination Department in 1881, satisfactory progress has been made in vaccination work, "and there was every prospect," the Army Sanitary Commission notice, "of a lower death-rate from small-pox, until the rise in 1883 to nearly "double the rate of 1881 and 1882 threw doubts on the future. There are many things "about small-pox which have yet to be learned, and, amongst others, this very matter shown "in the Punjab experience, which, however, is not peculiar to India, namely, how it happens "that, with an improved and extended vaccination service, the death-rate should suddenly "duplicate itself. We have no present means of knowing, but in this as in other sanitary "questions, we must in the meantime be guided by experience. We must go on improving "the general sanitary condition of the population, to render the people less liable to epidemics, "and the efforts of the vaccination staff must be exclusively directed to the protection of "infants, for until the births are overtaken by the vaccinations, we shall have no right to "complain of occasional epidemics of this disease."

The number of deaths registered under fevers was 306,185 or 16·25 per 1,000 of population, being 40,495 or 2·15 below the mortality of the previous year, and 5·69 per 1,000 less than the quinquennial mean. These years, however, contain the famine period 1878–79; still, compared with the three subsequent years 1880–82, the rate for 1883, as pointed out by the Army Sanitary Commission, shows a reduction of over 2 per 1,000, "which," they say, "would be so far satisfactory if it really were due to the advance of sanitary improve-"ment. This, however, is doubtful, for the Sanitary Commissioner appears to have shown "that, just as the great fever rates of 1878 and 1879 were due to the accidental intercalation "of food scarcity, which increased the susceptibility of the people to the action of ordinary "fever causes, so the lower death-rate of 1883 was mainly due to the reduction of rain in "that year." In seven districts the fever death-rate was over 20 per 1,000, Muzaffargarh recording the highest, viz., 29·27; in the remaining 25 districts the ratios ranged from 17·91 in Shahpur to 5·91 in Simla.

From bowel complaints the deaths amounted to 14,607 or 0·77 per 1,000, being 1,353 less than the number recorded in 1882. Amongst other diseases, chest affections appear to be very prevalent and fatal in the Punjab during the winter and early spring months. From these diseases, 30,681 deaths were registered. The Army Sanitary Commission consider "that the Sanitary Commissioner is doing good service to the public health cause in the "Punjab by rescuing these deaths from the general confusion during recent years; for, in so "doing, he has shown that climate has a very important influence at present, without "adequate compensation in local habits on the public health of the province, and that the "mortality entered under this new head is of far more importance numerically than the "mortality from cholera."

The year 1883 in the North-Western Provinces and Oudh was on the whole a healthy one. The rainfall was light, especially in the autumn months, but it was well distributed, and

food grains were plentiful and unusually cheap. Registration of births and deaths continued to improve. The number of births registered during the year was 1,801,401 or 40·84 per 1,000 of population, the highest ratio on record since 1879, when the system of birth registration was completed, and against 1,656,159 or 37·54 in 1882. It is worthy of remark also that the birth-rate of 1883 was the highest in any of the provinces of India. The total registered deaths numbered 1,216,297 or 27·57 per 1,000, less than in any year since 1877, and 268,820, or 6·10 below the mortality of 1882. It will be seen that the birth-rate exceeded the death-rate by 13·27 per 1,000.

Cholera was less prevalent here during 1883 than in any of the previous nine years, and the only district in which it occurred in anything like epidemic form was Banda, while even there the disease was confined to special localities. The total deaths numbered 18,160 or 0·41 per 1,000 against 89,372 or 2·02 in 1882. Out of 49 districts 3 were entirely free of cholera, and only 7 were affected with any severity. The district of Banda recorded 3,845 deaths or 5·50 per 1,000 of its population. Mirzapur followed with 1,689 or 1·48, Ghazipur with 1,419 or 1·39, and Benares with 1,233 or 1·38 per 1,000. The urban mortality was more than twice as great as the rural mortality, namely, 0·81 against 0·39. Only 2·4 per cent. of the total 105,421 villages recorded cholera deaths.

Deaths from small-pox were much more numerous than in 1882, or in any year since 1869, with the exception of 1878. From this disease 136,641 deaths were recorded in 1883, or a ratio of 3·14 per 1,000, against 26,628, or 0·60, in the previous year. The districts most affected were the central and northern districts of Oudh and the adjoining tracts of Rohilcund north of the Ganges. The mortality in the districts of Bara Banki, Hardoi, and Lucknow, situated in the very centre of Oudh, was especially high, viz., 17·53, 14·15, and 13·80 respectively, the mean of the three being 15·16 per 1,000 of population. "The "nearest approach to a record like that," the Sanitary Commissioner states, "occurred in "the three districts of Oudh (Sitapur, Hardoi, and Unao) in 1878, when their mean was "11·10. And I think there can be no doubt that, as a matter of recent history, Oudh is "the country of this province in which small-pox has greatest power. And, at the same "time, it is the portion of the province in which vaccination has made least progress."

Owing to the favourable climatic conditions of the year, fevers caused a smaller mortality than in 1882, the number of deaths being 830,258 or 18·82 per 1,000 against 1,098,414 or 24·90, showing a decrease in 1883 of 268,156 or 6·08 per 1,000. Tarai, as usual, headed the districts with a ratio of 41·61 or more than double the provincial rate. Five other districts recorded ratios varying from 25·11 to 27·41. "It is to be remembered always," the Sanitary Commissioner observes, "that these ratios of mortality from fever disease are "exaggerated proofs of its prevalence, because a larger proportion of the deaths recorded "under the head fever have really happened from quite other causes; and I think it likely "that if these deaths from other causes could have been eliminated from the record in 1883, "which was certainly a year of extraordinary absence of fever disease, the ratio for fever "would have been very light."

The mortality from bowel complaints was considerably below the average of former years, the total deaths numbering 66,530 or 1·50 per 1,000 against 93,661 or 2·12 in 1882. By districts the highest death-rate was recorded in Hamirpur, viz., 11·41, Garhwal following with 11·06; in six other districts the ratios ranged from 8·47 to 5·46, and in 11 others the provincial ratio was exceeded. The Sanitary Commissioner is of opinion that most of the deaths recorded under bowel complaints may be attributed to dysentery.

Central Provinces.

In the Central Provinces the year 1883 was an unhealthy one, though food was generally cheap and abundant. The area of registration of vital statistics was slightly increased, and the population raised from 8,802,040 to 8,817,185. Amongst this population, 357,864 births were registered, or at the rate of 40·59 per 1,000, being 9,464 less than the number of the previous year. Out of the 20 districts the birth-rate was above the provincial average in 8 (Murwara being conspicuous with a ratio of 54·29), and below in 12. The registered deaths rose from 263,368 or 29·98 per 1,000 in 1882 to 304,763 or 34·56, showing an increase in 1883 of 40,895 or 4·58 per 1,000. This increase was spread over 13 districts, and was contributed to by all the chief diseases.

Cholera was much more prevalent in 1883 than in the three previous years, and caused the death of 16,235 persons or 1·84 per 1,000 of population against 11,932 or 1·36 in 1882. The epidemic began in May and reached its height in August, when nearly a half (7,944) of the mortality was recorded, it then began to decline, until in December no cholera death was reported. As regards the mortality in individual districts, statistics show that those which suffered most in 1882 had comparatively little cholera in 1883, while those which had few deaths in 1882 were the principal sufferers in 1883. In the four districts of Burhanpur, Chindwara, Wardha, and Nagpur, the disease appears to have been very severe, the death-

rates ranging from 9·72 to 6·96 per 1,000. Notwithstanding the severity of the epidemic all the deaths were furnished by less than 5 per cent. of the 28,427 villages. In some of the towns the mortality was excessive, especially in Narkher in Nagpur district, where, out of a population of 7,061, the deaths numbered 300 or 42·49 per 1,000. The two great fairs of the provinces, Birman and Ramtek, escaped the epidemic. "The epidemic history of 1883 "confirms," the Army Sanitary Commission state, "that of all previous epidemics. It has "shown that before there can be wide-spread epidemic mortality, there must be cholera, "more or less, existing over a country, wherever it may come from. That, when cholera is "present, all the population groups do not necessarily suffer. Some, or rather the large "majority, escape in any given year, otherwise the country would be depopulated, but the "escape of one year is no guarantee for another year's immunity. That local cholera "outbreaks are intimately related to filth, damp, crowding, and bad water, but that, by "preventing these insanitary conditions at fairs, the people are protected from cholera "which at the very time may be causing the loss of life in their homes."

Small-pox was also more fatal in 1883 than in the previous year. All the districts were affected; but the entire mortality (4,696 or 0·53 per 1,000) was recorded in only 7 per cent. of the total villages. In 1882 the deaths from this disease numbered 3,945 or 0·45 per 1,000. The provincial ratio was exceeded in 9 districts out of 20, 4 recording ratios considerably higher than any of the others, viz., Nimar, 3·60; Burhanpur, 2·06; Mandla, 1·65; and Damoh, 1·41. In no other district did the mortality exceed 1 per 1,000 of its population. Of the total deaths, 1,732 occurred among children under one year of age, and 2,406 among children between one and twelve years.

The deaths ascribed to fevers numbered 175,119 or 19·86 per 1,000 against 152,407 or 17·31 in 1882. But there appears to be little doubt that a large number of deaths returned under fevers really resulted from other causes. The question was specially inquired into by the Civil Surgeons of the Hoshangabad and Chanda districts, with the result that out of 77 deaths said to be due to fever investigated in the former district only 41 per cent. were apparently caused by fever; and of 150 cases in the latter district only 27 per cent. were actual fever deaths. A further inquiry was also made by the Civil Surgeon of Hoshangabad with the view of ascertaining the true proportion due to each of the most easily recognised diseases. Out of 365 deaths investigated he found that 35 per cent. against 69½ returned by the Police were due to fever, 20·8 to bowel complaints, 16·7 to chest diseases, and 27·4 to other diseases. The Army Sanitary Commission point out that if these ratios could be accepted as general, the fever mortality for the Central Provinces, instead of being 57 per cent. of the total deaths would be 35 per cent., and that the fever death-rate would be reduced from 19·86 per 1,000 of population to 12½, "which is a third more than has been assigned under "the present registration to other provinces of India. . . . It follows," the Commission state, "that, making every deduction for errors in diagnosis, the abatement of fever causes "constitutes the sanitary problem of the Central Provinces."

Under bowel complaints 26,623 deaths were registered equal to 3·02 per 1,000 of population, being 1,984 in excess of the number of the previous year. The district of Sambalpur, as usual, was conspicuous by the high death-rate (12 per 1,000) due to these diseases. "It would appear," the Army Sanitary Commission remark, "as if these bowel "complaints at Sambalpur were of local origin, because, notwithstanding the supposed "relation of cholera to these affections, Sambalpur had not a single death from cholera in "1883, and its previous five years' cholera rate had been only 1·42 per thousand. Bad "unwholesome drinking water may be one cause of prevalence of bowel diseases in this "district, as the people appear to be infested with worms."

In Berar the year 1883 was one of excessive mortality. Not only was there a severe epidemic of cholera, but all the other forms of disease appear to have been unprecedently active, especially fevers and small-pox. This special unhealthiness is attributed to an abnormally high temperature during the months of April and May and an unusually heavy rainfall, which for the year amounted to 53 inches against an average for the previous 14 years of only 33 inches. The registration of vital statistics is reported to have been fairly carried out during the year, though there is yet much room for improvement. The number of births registered was 105,921 or 40·3 per 1,000 of population less than in 1882 by 4,533 or 1·7 per 1,000; and the registered deaths amounted to 135,081 or 51·3 per 1,000, a greater number than in the previous year by 57,867 or 21·9 per 1,000. It will thus be seen that the death-rate for 1883 exceeded the birth-rate by 11 per 1,000. The most unhealthy months of the year were July, August, and September, when nearly one-half of the total deaths occurred. As usual during epidemics the mortality amongst children was excessive, no less than 51¼ per cent. of the total registered deaths having taken place among children under five years of age. "The insanitary condition in which the people live," the Sanitary Commissioner remarks, "is sufficiently prejudicial to the rearing of children to, in

"itself, account, in a great measure, for the high rate of mortality among the infant "population, and the experience of the past year further shows that during epidemics this "insanitary condition makes itself felt in a much greater degree, and that whenever epidemic "disease occurs, children suffer the most."

Cholera accounted for 27,897 deaths or 10·60 per 1,000 of population against 3,573 or 1·34 in 1882. The epidemic commenced about the middle of April at two points remotely distant from each other, one in the extreme south in the Basim district, the other in the north in the suburbs of Amraoti, and it was confined to these two districts until June, when the epidemic became general throughout the province. The chief distribution of the disease, however, was in Ellichpur and Basim districts, where the death-rates reached 19 and 13·3 per 1,000 respectively. Out of a total of 5,564 villages 33 per cent were affected by cholera; being nearly four times greater than the number in the previous year. The Sanitary Commissioner was of opinion that the severity of the epidemic had some connection with the heavy rainfall of the year; "but taking the evidence furnished by the data as a whole, we "should scarcely be justified," the Army Sanitary Commission state, "in adopting the "conclusion." There can be little doubt, however, that the general insanitary condition of the villages aided considerably in developing the epidemic.

Small-pox prevailed in an epidemic form throughout the year, visiting all the districts, though the entire mortality was furnished by less than 1·1 per cent. of the villages. The deaths numbered 3,858 or 1·46 per 1,000 of population, more than ten times greater than the mortality of 1882. By comparing the death-rates for the 16 years ending 1883 it is seen that of late years there has been a considerable diminution of small-pox. For the first eight years of this period the aggregate death-rate is 14·8 per 1,000, and in the second eight years it is only 7·53. This decrease of mortality co-existed with a considerable increase of vaccination, as is shown by the fact, that while in the first eight-year period the aggregate ratio of successful vaccinations per 1,000 of population was 104·1, in the second period the aggregate ratio was 255·4 per 1,000.

The deaths ascribed to fevers numbered 53,593 or 20·37 per 1,000 against 39,340 or 14·95 in 1882. This mortality was generally distributed, all the registration circles having returned deaths, and 72 per cent. of the 5,564 villages. "Attention has been repeatedly drawn in "previous reports," the Sanitary Commissioner observes, "to the constant relation existing "between rainfall and fever mortality. With the advent of the rains the temperature falls, "soil and air become saturated with moisture, the days are hot and the nights chilly, owing to "rapid evaporation causing sudden alternations in temperature, and the people, as a rule, are "underclad. The consequence of this exposure to cold, chills, and damp is an increase of "sickness and mortality generally by lowering the disease-resisting powers of the people, and it "is at this season of the year that fevers both intermittent and remittent are rife. The best "protection against these climatic fever causes is better drainage and warmer clothing, "sufficient to protect the body from receiving a chill." While fully admitting the influence of wet years on the prevalence of fever, the Army Sanitary Commission urge that the treatment of local causes by sanitary measures should not be neglected. "We have little "doubt," they say, "that if the towns and villages were placed in a thoroughly wholesome "condition there would be a great reduction in the district fever death-rates; but looking "at the relation between these rates and the district rainfall, it seems not at all unlikely that "the local topography exerts a not unimportant influence on the amount of fever."

The deaths registered under bowel complaints amounted to 19,044 or 7·24 per 1,000 against 13,546 or 5·1 in 1882. By districts the ratios varied from 0·8 per 1,000 in Wun to 11·3 in Akola. "It seems likely," the Army Sanitary Commission remark, "that the higher "death-rate of 1883 may have had some relation to the severe cholera epidemic of the same "year, as there was a correspondence between the monthly deaths from both diseases."

Assam.

Of late years registration of vital statistics in Assam has made great progress, and with the exception of some hill tracts the entire province in 1883 was brought under the system. Out of a total population, according to the census of 1881, of 4,881,426, births and deaths were registered among 4,527,934; but the results do not manifest the same improvement in accurate registration as in the previous year. The registered births fell from 112,444 or 24·83 per 1,000 in 1882 to 108,269 or 23·91 in 1883, and the deaths rose from 117,384 or 25·92 to 122,932 or 27·14, thus showing an excess of deaths over births of 14,663 or more than 13 per cent. "Both rates" (birth and death), the Army Sanitary Commission remark, are evidently under the truth, but both rates show good registration when all the circumstances are taken into account, and we must hope that as the work has been fairly started, the results in future years may teach us more of the real sanitary condition of the province."

There was a marked diminution in cholera mortality as compared with 1882; but it was still much in excess of either of the two previous years. In 1883 the deaths numbered 14,908 or 3·29 per 1,000 against 21,055 or 4·66 in 1882. Every district suffered, but the entire mortality was confined to 15½ per cent. of the total 13,296 villages. Four out of the eight districts of the province showed an increased mortality, notably Darrang, which recorded a cholera death-rate of 9·28 against 3·37 in 1882. With reference to the monthly incidence of the disease the Sanitary Commissioner states: "The figures are again confirmatory of the "curious fact which has so frequently attracted observation, and especially in the comments "of the Army Sanitary Commission on the Assam Sanitary Report for 1881, that the "cholera invasion of Assam presents a striking seasonal difference in each of the two great "valleys (Brahmaputra and Surma) into which the province is divided. The figures are not "so striking in their contrast as for 1882; but the fact stands out clearly that cholera in "Assam fades away in a remarkable manner when the water overspreads the land, leaving "the Surma valley more like an archipelago than a provincial area."

The deaths registered under small-pox amounted to 6,162 or 1·37 per 1,000, nearly double the totals in the two previous years. Of the year's mortality, 1,325 deaths took place among children under one year of age, and 3,179 among those under 10 years of age. All the districts showed an increased mortality except Nowgong and Sibsagar, the excess being most marked in Cachar, where the deaths rose from 23 in 1882 to 1,623 in 1883, and in Sylhet from 378 to 2,584.

Fevers accounted for 67,494 deaths or 14·90 per 1,000 against 60,218 or 13·43 in 1882. In the three districts of Darrang, Nowgong, and Sibsagar there was a slight decrease in fever mortality, while the remaining five districts showed an increase; but only in Goalpara and Sylhet was the increase at all considerable. In Goalpara the mortality rose from 26·27 to 32·28, which is more than twice as high as the provincial rate. The increase was mostly due to the spread of the disease known locally as kalar azar, a paludal fever which appears to be prevalent among the Garos resident in low lands of the Goalpara subdivision. Steps were taken to relieve the villages affected with this disease; "but it is difficult," the Sanitary Commissioner says, "to relieve the sufferers. They believe in incantations, and will not take "European medicines; they cannot be persuaded to undergo hospital treatment as in-patients, "and they live surrounded by every conceivable insanitary condition in a country which for "the greater part of the year is practically inaccessible. To add to the difficulty, the fever is "generally of a lingering character, the sick dying ultimately from blood degeneration, and "in their impatience the Garos will not accept prolonged treatment, which is essential to "their cure." As regards the nature of the disease, the Commissioner states, "that it is a "marsh ague in its causation, intensified through chronic lapses into a blood taint, which "passes into anæmia and organic congestions, and that it is only especially fatal because the "sick among Garos are left uncared for, unnourished, and exposed to continued relapses." In discussing this fever, the Army Sanitary Commission remark: "No doubt lives might be "saved which are at present lost for want of medical treatment; but the account of this "*kala-azar*, or black sickness, shows that it is a very fatal form of Terai fever, prevalent in "districts situated at the junction of hills with the low Assam plain, occasionally extending "up the lower hill ranges, and causing death by visceral complications of a very intense "character."

The registered mortality from bowel complaints in 1883 was almost identical with that of the previous year, the deaths numbering 14,474 or 3·19 per 1,000 against 14,374 or 3·13 in 1882. These complaints showed a decrease in the district of Darrang, but in the rest of the province there was an increase.

British Burma.

Registration of vital statistics in British Burma in 1883 still remained very imperfect. The subject, however, was under consideration during the year, and resulted in the publication of new rules, which it is hoped will lead to more reliable statistics in future. The registered births for the year numbered 83,735 or 22·92 per 1,000 against 80,848 or 22·07 in 1882, and the registered deaths 53,583 or 14·67 against 59,146 or 16·14. "It is evident," the Army Sanitary Commission remark, "that both rates (birth and death) are considerably "below the truth. Both are means for the whole country, and both include quite impossible "ratios for some of the districts." The birth-rate was made up of extremes, varying from 16·60 per 1,000 in Pegu district to 31·65 in Henzada, and the death-rate of extremes ranging from 9·22 in Tharrawaddy to 21·42 in Hanthawaddy.

Of the chief diseases, cholera showed a considerable diminution, the deaths having decreased from 7,177 or 1·96 per 1,000 in 1882 to 2,185 or 0·60 in 1883. The disease prevailed more or less in all the districts, but it was epidemic in severe form only in Akyab, Bassein, Thongwa, and Shwegyin, which together returned more than two-thirds of the total deaths. Although the disease extended over the whole province, the entire mortality took place in

only 0·85 per cent. of the villages. Some of the towns recorded very high cholera death-rates, notably Akyab, with a ratio of 4·62 per 1,000. In this town there were two outbreaks during the year; the second extending afterwards to the jail. The Sanitary Commissioner reports that segregation and disinfection entirely failed to check the disease spreading in the jail, and that it was not stamped out until the jail had been evacuated by the bulk of the prisoners. "This Akyab epidemic," the Army Sanitary Commission state, "has afforded additional "experience on the dangers that may accrue during cholera invasions from agglomeration of "people, and also the necessity of avoiding all such crowding."

The mortality from small-pox was again very low, only 675 deaths were registered, or in the rate of 0·18 per 1,000 of population against a ratio of 0·21 in the previous year. Children, as usual, were the chief sufferers, two-thirds of the mortality having occurred amongst those under 12 years of age. Six out of the 16 districts of the province were exempt from the disease, and the entire mortality was returned from only 27 of the total 14,811 villages.

Fever deaths were registered to the number of 26,283 or 7·19 per 1,000 against 27,093 or 7·39 in 1882. By districts the highest ratios were recorded in the three comprised within the Arakan division, viz., 12·02 in Akyab, 11·22 in Kyaukpyu, and 11·45 in Sandoway; in the remaining 13 districts the mortality ranged from 3·41 in Thongwa to 10·50 in Thayetmyo, both of the Irrawaddy division.

Under bowel complaints 2,781 deaths were registered or 0·76 per 1,000 against 3,291 or 0·90 in 1882. Deaths were recorded all over the province, but the whole mortality was returned from only 0·70 per cent. of the total 14,811 villages. These complaints are much more prevalent among natives of India than among Burmese. This is attributed partly to the habit of sleeping on the ground, while the dwellings of the Burmese are invariably raised several feet. "A very common cause of dysentery and diarrhœa amongst Indian immigrants "to this province is," the Sanitary Commissioner says, "starvation. Many coolies on public "works and otherwise employed here deprive themselves of the necessaries of life to enable "them to remit monthly to their relations in India a large proportion of their wages."

IV.—JAILS.

Sickness and mortality in 1883.

The health of the jail population of India in 1883 was, on the whole, very satisfactory. Compared with the two previous years and the average of the period 1877–81 the results of 1883 show a marked reduction both in sickness and in mortality. Of an average strength of 88,174, which was over 6,000 below that of 1882, the admissions into hospital, according to the Report of the Sanitary Commissioner with the Government of India, fell from 1,214 per 1,000 in 1882 to 996, the daily sick from 42 to 36 per 1,000, and the death-rate from 39·36 to 31·37. The decrease in sickness was mainly attributable to the reduced number of cases of intermittent fever, the admissions under which were in the rate of 352 per 1,000 of average strength against 513 per 1,000 in 1882. Cases of bowel complaints and respiratory diseases were also considerably less than in the previous year.

The following statement gives the sickness and mortality among the prisoners of the various provinces of India during 1882 and 1883:—

Provinces, &c.	1883. Ratio per 1,000 of Average Strength.			1882. Ratio per 1,000 of Average Strength.		
	Admissions.	Daily Sick.	Deaths.	Admissions.	Daily Sick.	Deaths.
Bengal	1,498	50	52·21	1,642	54	69·21
Madras	861	32	29·87	795	29	42·62
Bombay	734	27	34·33	843	26	33·35
Punjab	951	27	29·11	1,546	45	41·63
North-Western Provinces and Oudh	563	23	19·76	724	29	22·93
Central Provinces	919	36	70·97	966	41	71·05
Berar	558	14	8·49	449	12	8·50
Assam	2,125	56	43·12	1,735	45	33·08
British Burma	1,159	38	28·94	1,468	39	27·81

The above data, as the Army Sanitary Commission point out, show how very different are the sick and death-rates in different groups of jails. "It is true," they say, "that the facts only "apply to a single year, but they are quite sufficient to justify a recommendation that the "whole subject of current comparative death-rates, and the causes of their differences should "be inquired into. It need scarcely be stated that these local facts detract considerably from "the favourable impression produced by the year's statistics when taken over the whole "prison population."

Bengal.

For some years past, the vital statistics of the Bengal jails have been the subject of most anxious attention on the part of the Local Government, and great efforts have been made to improve the condition of the jails and of their inmates. Large sums have been spent on various sanitary improvements; the diet of the prisoners has been varied, or increased when considered advisable; better water-supply has been provided, besides many other improvements in matters connected with the well-being of the prisoners. It would seem that to some extent at least the efforts of the Government have at last been crowned with success, as for the first time since 1878 the health statistics show a very decided improvement. Of an average strength of 14,776 which was less than that of 1882 by 1,126, the admissions fell from 1,642 per 1,000 in 1882 to 1,498, the daily sick-rate from 54 to 50, and the death-rate from 69·21 to 52·21, showing a reduction in mortality of 17 per 1,000.

Amongst the convict class the admissions into hospital were in the rate of 1,600·7 per 1,000 of average strength against 1,741 in 1882, the daily sick-rate 51, or 4 less, and the death-rate 53 against 69·8. The chief causes of sickness were intermittent fevers, which contributed a third (550·7) of the total admission-rate, dysentery and diarrhœa following with a rate of 499·5. As regards mortality, the most important factors were dysentery and diarrhœa from which there were 299 deaths or 21·8 per 1,000. Cholera was considerably less prevalent than in the previous year, the number of cases having declined from 256 to 111, and the deaths from 146 to 53. Jalpigoree was the only jail in which cholera prevailed in a severely epidemic form; there it attacked 16 prisoners, chiefly new admissions, of whom 13 died. Excluding cholera, the convict death-rate is reduced to 49·2 as against 60·0 in 1882, 63·4 in 1881, 64·4 in 1880, and 80·4 in 1879. In these figures the Inspector-General of Bengal jails points out, "we have evidence of a steady improvement in the general health

" of the prisoners, and this, too, notwithstanding the facts that the health of the free " population continues to be injuriously affected by the extraordinary prevalence of malarious " fever in many districts, and the increasing prices of food grains."

As regards the mortality in individual jails, 20 recorded death-rates in excess of the average rate, but only seven showed ratios above 10 per cent., while in the previous year there were 12.

The following 10 jails showed death-rates exceeding 75 per 1,000 :—

	Death-rate per 1,000 of Average Strength.		Death-rate per 1,000 of Average Strength.
Julpigoree	261·9	Dinagepore	107·6
Lohardugga	198·0	Midnapore, *District and Central*	104·5
Rungpore	196·9	Patna	88·8
Bogra	148·0	Dacca, *District and Central*	78·8
Nuddea	118·3	Beerbhoom	78·8

With the exception of Lohardugga, all the first six jails, the Inspector-General states, " are " situated in malarious districts, and the mortality may fairly be ascribed to climatic causes." With reference to the mortality in the Julpigoree jail, which was 186·6 per 1,000 greater than in 1882, the Superintendent, in his medical report for the year, observes: " The chief causes of " sickness are shown in the return to have been bowel affections, but in nearly every case " these are merely symptomatic of a general diseased condition, the result of prolonged " exposure to malaria. It is unnecessary for me to enumerate here the conditions that " result from repeated and severe attacks of malarial fever. Suffice it to say that these " conditions are met with here in the most pronounced form, so much so, that I think it is " reasonable to suppose that these miserable broken down creatures, being unable to provide " for themselves in a legitimate fashion, degenerated from sheer necessity into the criminal " classes."

It is satisfactory to find that out of 47 jails 20 showed a decreased mortality compared with the previous year. These were the following :—

Jails.	Death-rate per 1,000.		Jails.	Death-rate per 1,000.	
	1883.	1882.		1883.	1882.
Beerbhoom	78·8	117·5	Purneah	37·8	114·2
Moorshedabad	74·3	107·1	Shahabad	28·7	77·4
Chumparun	60·3	193·8	Maldah	18·0	37·9
Monghyr	59·2	80·5	Buxar, *Central*	18·3	91·7
Mymensingh	56·5	272·1	Tipperah	16·6	39·8
Mozufferpore	55·8	116·5	Singbhoom	16·6	102·8
Backergunge	53·6	103·8	Bhagulpore, *Central*	12·7	46·6
Burdwan	47·6	142·8	Darjeeling	—	78·6
Hazaribagh, *District and Central*	43·0	64·9	Noakholly	—	51·4
Sarun	39·0	85·0	Balasore	—	40·1

It will be seen from the above that the improvement in some jails has been very considerable, especially in such notoriously unhealthy jails as Mymensingh, Chumparun, and Singhbhoom.

" The death-rate among prisoners in the jails, taken as a whole," it is observed in the Government resolution on the Report for 1883, " has much diminished; the reduction in that " from cholera may perhaps continue, and the completion of the large jail operations may " have a beneficial effect on the general health of the jail population. But in the face of the " experience of the last few years, the Lieutenant-Governor cannot hope that the mortality " among prisoners will be materially reduced until sanitary reform has reached the interior " of our districts, and there is a permanent improvement in the health of the general " population."

Madras. Amongst the prison population of the Madras Presidency sickness was more prevalent during 1883 than in the previous year, but the mortality was considerably less. The admission-rate per 1,000 of average strength was 861, and the daily sick-rate 32 against 795 and 29 respectively in 1882, while the death-rate declined from 42·62 to 29·87, an improvement which was mainly due to the great reduction in mortality at Trichinopoly central jail.

The jail death-rates varied from 7·54 per 1,000 in Rajahmundry district jail to 116·96 in Ootacamund; in 21 jails out of a total of 35 the mortality was under 50 per 1,000, and in six, including the debtor's prison, there were no deaths.

The high death-rate in the Ootacamund jail was attributed to alternations of temperature affecting gangs of men transferred from the plains, whose constitutions were shattered by malarious fever. Tanjore jail recorded the next highest death-rate (86·52), but this is stated to be an old jail, and has long been condemned. Bellary followed with a death-rate of 77·49, attributed chiefly to the inclemency of the cold weather which was unusually severe. In Cuddalore jail the mortality was high (73·70 per 1,000), the principal cause being epidemic cholera, from which there were 9 deaths out of a total of 16. The Trichinopoly jail recorded the next highest mortality, 55·14 against 176·77 in 1882. This undue mortality was the subject of special inquiry, and was traced to the bad quality of the water and to the want of sufficient care in the preparation of the ragi flour used in the jail. It is satisfactory to note that the statistics of this jail for 1884 show a further improvement. The causes of the mortality of former years was, however, still under investigation. The only other jail calling for special notice is Cannanore, where the mortality reached 41·62 per 1,000; many of the deaths in this jail occurred amongst men of advanced age sentenced to transportation, but not deported on account of infirmity.

As regards convicts the death-rate was 29·49 per 1,000 against 42·67 in 1882. Of the total 228 deaths amongst this class, 77 were due to bowel complaints, 44 to anæmia and general debility, 20 to respiratory diseases, 13 to cholera, and 8 to fevers.

Bombay.

Sickness was less prevalent among the prisoners of the Bombay Presidency than in 1882, but the mortality was slightly greater. The admission-rate in 1883 was 734, and the daily sick-rate 27 per 1,000 against 843 and 26 respectively in the previous year; but the death-rate rose from 33·35 per 1,000 in 1882 to 34·33. This slight increase was due to the prevalence of cholera, the deaths from which were twice as numerous as in 1882, viz., 15 against 7. Of the total 262 deaths which occurred during 1883, more than half (134) took place in three of the four Sind jails, viz., Hyderabad, Shikarpur, and Nara, principally in Shikarpur, where the deaths amounted to 66, equal to 101 per 1,000 of average strength. For some years past the mortality in this jail has been very high, and a source of great anxiety. In 1882 it was attributed to chills caught in the early morning; but in spite of all precautions the mortality continued to be abnormally high. The Superintendent of the jail arrived at the conclusion that the heavy mortality was due to true cerebro-spinal fever, and, in the absence of any specific cause for the disease, he attributed it to great vicissitudes of temperature, intense cold and exposure, unsuitable diet, and predisposing malarial influences. The high mortality in the Hyderabad and Nara jails was also attributed to the same disease. The Governor in Council has directed that measures should be taken to obviate the large amount of sickness and mortality in these three jails by the adoption of proper means to protect the prisoners. But while in these three jails the results were so unsatisfactory, it is gratifying to note that 16 out of the 27 jails in Bombay Presidency returned death-rates below the average for the year, and that in four jails there were no deaths. The chief causes of mortality among the prisoners were respiratory diseases which yielded 54 deaths, dysentery and diarrhœa followed with 43, fevers with 30, anæmia and general debility with 22, and cholera with 15, of which six took place in the Mhasvad gang, four in Dhulia, two in Belgaum, and one each in Yerrowda, Ahmednagar, and Kaira. All but three of the 262 deaths occurred among convicts, giving a death-rate of 34·9 per 1,000.

Punjab.

The statistics of the Punjab jails for 1883 are very satisfactory. Among all classes of prisoners the admissions to hospital were in the ratio of 951 per 1,000 of average strength against 1,546 in 1882, the daily sick-rate 27 against 45, and the death-rate 29·11 or 12·52 per 1,000 less than that of the previous year, and lower than in any year since 1871. The decrease, however, was entirely confined to convicts, for among under-trials and civil prisoners there was increased mortality. The convict death-rate fell from 43·69 per 1,000 to 29·82, showing a decrease of 13·87. As previously stated, there was very little cholera in the province during the year, and all the jails were exempt from the disease; while among all other serious diseases there was a general improvement in the jails. In the previous year the following four jails recorded the highest death-rates; but it will be seen that they all showed a marked improvement in the year under notice:—

	Death-rate per 1,000 of Average Strength.	
	1883.	1882.
Lahore, Central	66·02	113·33
Lahore, District	36·82	64·58
Amritsar	28·33	62·69
Lahore, Female	27·93	62·17

Of the total 35 jails in the province, in 22 there was a decrease in the death-rate, amounting on an average to 18·66 per 1,000 of average strength; the largest decrease being 51·50 per 1,000 at Dharmsala. In 10 jails there was an increase in the death-rate, the average excess being 15·36 per 1,000; Simla shows the highest increase, viz., 55·55. In the opinion of the Inspector-General the health of the jail population is much regulated by the general health of the province, and the cause of much of the improvement in the health of the prisoners is due to conditions external to prisons, and common to both the free and prison populations. While admitting the force of this remark, the Lieutenant-Governor considers that the unremitting care and attention to proper food, clothing, accommodation, and sanitation, which have been shown by the superintendents of the jails, have materially contributed to the improved state of things which now exist.

North-Western Provinces and Oudh.

There was also a very marked improvement in the health of the prison population of the North-Western Provinces and Oudh as compared with previous years. The admission-rate for all classes of prisoners fell from 724 per 1,000 in 1882 to 563, the daily sick-rate from 29 to 23, and the mortality from 22·93 to 19·76. Of the 461 deaths that occurred, 30 were attributed to fevers, 106 to bowel complaints, 92 to respiratory diseases, and 50 to cholera; in the previous year there were 22 cholera deaths. In the year under notice cholera was confined to the Gorakhpur, Muttra, and Agra jails, but it was most severe at Gorakhpur, where there were 57 cases of which 38 proved fatal; at Agra 11 fatal cases were recorded. At both jails vigorous measures were taken to check the disease, and the prisoners were removed to camps; but at Gorakhpur the camp had to be shifted three times before the epidemic disappeared.

Of the 52 jails in the province six recorded death-rates of over 50 per 1,000, viz., Gorakhpur 147·86, Dehra Dun 126·33, Banda 64·63, Orai 60·10, Almora 56·51, and Mirzapur 51·65; in five others the death-rates were over 30, but under 40 per 1,000. Some of these have long had a reputation for comparative unhealthiness. The average population was considerably under the number for which there was room in the jails, but at a few of the jails there seems to have been some crowding. During the year a committee sat to consider the advisability of closing the Meerut central jail, notorious for the prevalence of fever; they recommended that it should be kept open for two more years, and it was ultimately decided by Government not to allow any more prisoners to enter it, but to keep the jail on with its present inmates, and to enlarge the Bareilly and Fategarh central prisons, and to divert the future streams of convicts, which formerly flowed to the Meerut central prison, to those two jails.

Central Provinces.

The health statistics of the jails of the Central Provinces for 1883, although showing a slight improvement compared with those of the previous year, were on the whole unsatisfactory. The admission and daily sick rates were 919 and 36 respectively per 1,000 of average strength against 966 and 41 in 1882, and the death-rate was 70·97 against 71·05. This high mortality was chiefly due to bowel complaints, from which there were 163 deaths out of a total mortality of 277. Raipur and Nagpur jails again suffered most severely from these complaints, no less than 82 deaths having occurred in the former and 50 in the latter. In the Jubbulpore jail also the mortality under this head was high, 10 deaths having occurred, or a fourth of its total mortality. Out of the total 277 deaths these three central jails contributed 246, Raipur yielding 113 or 145 per 1,000 of average strength, Nagpur 92 or 110·3, and Jubbulpore 41 or 37·9. In the previous year, the high death-rate at Raipur was attributed to Kalahundi prisoners; in the year under notice the mortality in this jail was greatest amongst the Khond prisoners. "During the first six months of the year," it is reported, "the number of Khonds in hospital was always large. In July, however, 63 of "these prisoners were, on the suggestion of the Chief Commissioner, moved into camp a "short distance from the jail, and employed on out-door labour; they were also allowed "certain articles of food to which they were accustomed in their own country, and which "are not included in the ordinary jail dietary. Since then their health has rapidly improved, "and there is now no unusual sickness among them, although they have been moved back "into the jail." Cholera was present only in the Nagpur and Bhandara jails, the former yielding 10 deaths and the latter one.

Among convicts only the deaths numbered 274 or 20 less than in 1882, but the death-rate per 1,000 of average strength (73·2) was identically the same. In the Nagpur and Jubbulpore central jails the largest number of deaths in this class occurred amongst those who had been over a year in jail, while in Raipur 90 of the total 113 deaths were of convicts of less than one year's residence; of these, however, 55 were Khond prisoners.

Berar.

The health of the Berar jails was again very good, and bears witness to the attention paid to sanitary matters. Though sickness was somewhat greater in 1883 than in 1882, the admission-rate having increased from 449 to 558, and the daily sick from 12 to 14 per 1,000 of average strength, the mortality from all causes was identically the same, viz., 8·49 against 8·50. The statistics are the more satisfactory considering that the general health of the province was very unfavourable, the death-rate being 51·3 per 1,000 of population.

Nine deaths were recorded, all amongst convicts, and of these, two took place at the Amraoti central jail, five at Akola central jail, and two at the district jail of Ellichpur; at the remaining three jails in the province, Yeotmal, Buldana, and Basim, there were no deaths. Though cholera was present in all districts it did not enter the jails. Every care and attention was paid to the dieting of the prisoners, and the fact that upwards of two-thirds of the number increased in weight during their detention in jail, goes to confirm the opinion that the diet scale was amply liberal.

Assam.

The statistics of the Assam jails for 1883 are most unsatisfactory. The death-rate, which for four years had been decreasing, rose from 33·08 per 1,000 of average strength in 1882 to 43·12, the daily sick-rate also rose from 45 to 56, and the admission-rate from 1,735 to 2,125. These unfavourable results were attributed to the general unhealthiness of the year. The number of deaths was 66, of which 60 or 43·2 per 1,000 occurred among convicts against 44 or 32·3 in 1882. Of these 60 deaths, 9 were due to cholera, 23 to dysentery and diarrhœa, and 8 to general debility. The only considerable increase was in the Sylhet and Tura jails. In the former the increase in mortality from 20·3 to 52·8 is reported to have been due to an error of judgment in transferring a batch of sickly prisoners from Silchar. Orders were therefore issued that when prisoners have to be transferred from an overcrowded jail, healthy and able-bodied men should be chosen. In Tura the deaths increased from *nil* to 5 or 194·17 per 1,000 of an average strength of 26, and the entire mortality was due to the dreaded disease *kala-azar*, which was very fatal among the lower valleys of the Garo Hills (see *ante*, p. 16). Out of the 10 jails, in which there were no deaths in 1882, only four enjoyed that pre-eminence in the year under notice, besides one (South Sylhet) not included in the Report for 1882. Of the nine fatal cases of cholera, three occurred at Tezpur jail, at short intervals, at the time when the disease was prevalent in the district; two were recorded at Barpeta jail; and at the four jails of Sylhet, Shillong, Nowgong, and Silchar there were single sporadic cases, unaccompanied by any epidemic.

British Burma.

The results among the prisoners of British Burma in 1883 were much the same as in the previous year. The admissions to hospital were somewhat smaller, being in the ratio of 1,159 per 1,000 against 1,168 in 1882; the daily sick-rate remained the same, 39; but the death-rate rose from 27·81 to 28·94. This increase in mortality was due to the outbreak of epidemics of cholera at Akyab and Kyaukpyu, resulting in 26 deaths at the former and 15 at the latter. All the other jails were exempt from this disease except Ma-ubin, where there was one fatal case. Of the 14 jails in the province, Kyaukpyu recorded the highest death-rate, 169·23 per 1,000, of which 115·38 was due to cholera; Akyab followed with 132·02, nearly a half being caused by cholera; Mergui followed with a death-rate of 71·43, Ma-ubin with 49·50, and Henzada with 46·05. In none of the other jails was the provincial average exceeded, while in three jails there were no deaths. Of the total 155 deaths, all but four occurred among convicts, the death-rate per 1,000 of average strength being 29·60 against 26·4 in 1882. As in previous years, the greatest number of deaths occurred among newly admitted convicts. The average number of deaths among those who had been less than six months in jail was 57·55 per 1,000 against 62·2 in 1882, and of those who had been more than six but less than twelve months in jail, 25·51 per 1,000. Of the total number of deaths, 111 or 73·51 per cent. occurred among convicts who had been in jail less than a year. "It is possible," the Chief Commissioner observes, "that the slight decrease in the average "number of deaths among convicts recently admitted may to some extent be due to the "abolition of the reduced ration for short-term prisoners. The fact that the number of "prisoners who weighed more on release than they did on admission was nearly three times "as great as that of those who lost weight, speaks well for the general good health of the "prisoners."

V.—VACCINATION.

Fair progress was made in vaccination work in Bengal during 1883–84. The operations of the Government vaccinators were extended for the first time to portions of the Monghyr, Tipperah, Chumparun, Shahabad, and Gya districts, comprising an area of 6,179 square miles, with a population of 3,800,388; besides this an area of 4,416 square miles, containing a population of 1,916,568, was for the first time placed under the licensed system of vaccination. At the close of the season the thoroughly protected areas comprised 37,969 square miles, with a total population of over 15,000,000. The vaccination staff was considerably strengthened during the year, and resulted in the increase of the operations performed from 1,261,425 in 1882–83 to 1,361,332, and in the successful cases from 1,229,058 to 1,329,628. The increase, however, was not general, for in the Metropolitan, Darjeeling, and Sonthal Pergunnahs circles, there was a large decrease, especially in Darjeeling. The primary operations numbered 1,350,519, of which 98·66 per cent. were returned as successful, against a corresponding percentage in the previous year of 98·60. Of the total 1,324,853 successful primary operations, 178,487 were performed on infants under one year of age, and 877,338 on children between the ages of one and six years. It would thus appear that infants are very inefficiently protected from small-pox. By assuming a birth-rate of 30 per 1,000 the Sanitary Commissioner of Bengal calculates the births at 1,448,895, of whom only 12·32 per cent., exclusive of those who died, were successfully vaccinated. "Apart from "several other causes," the Sanitary Commissioner states, "the main reason why a larger "ratio of protection is seen among children above one and under six years of age than among "infants is that parents or guardians (particularly mothers) greatly fear to expose children "of tender age to vaccination, which is considered to be attended with much risk." Bengal.

The Compulsory Vaccination Act of 1880 was extended during the year to 56 towns and four thannahs. But little opposition was made to its operation; in fact, public feeling generally is said to be growing in favour of vaccination, though opposition, chiefly on religious grounds, is still exhibited. In Gya, for instance, where the town Act had been previously extended, obstinate resistance was made by the wealthy class of Hindus and the priests of the old town. The protection afforded by vaccination may be gauged by the fact that, while the mortality from small-pox in unprotected areas was ·23 per 1,000, in the thoroughly protected areas it was only ·07 per 1,000.

One interesting feature in connection with the vaccination administration was the great increase in the use of bovine lymph. It is reported that the demands for it during the year were so numerous that the establishment was barely able to cope with them. In no less than 1,352 instances the calf was required to be taken for vaccination to the houses of private persons, and the question was raised whether a fee should be charged in such cases in order to meet the expenditure involved. The Sanitary Commissioner considered that it was fully time that the bovine vaccination scheme should be made a permanent institution, and the Lieutenant-Governor expressed his willingness to consider any specific proposals that might be made with this object.

Progress was also made in vaccination in the Madras Presidency, but not sufficient to keep pace with the growth of the population. During 1883 there were 753,589 persons vaccinated, being an increase of 88,921 over the previous year. Of the total number, 736,662 were primary operations, of which 683,384 or 92·7 per cent. were successful, the highest percentage shown during the previous 10 years. As in 1882 children over one and under six years of age were the most largely protected, the number of successful cases being 334,623, and infants the least, only 131,371 having been successfully vaccinated during the year. In a great measure this is accounted for by the objections mothers have to early vaccination. It is reported that "on the appearance of the vaccinator in a village it is a "common custom for parents to send their children away to a neighbouring hamlet, and "stoutly deny having any." On the whole, however, the results as regards infants compare favourably with 1882, the successful vaccinations being in the ratio of 16·6 per cent. of the total births against 15·7. In some districts inoculation is said to be very much practised and greatly preferred by the people to vaccination. As it interferes greatly with the progress of vaccination, the Inspector of Vaccination has suggested that an Act should be passed prohibiting inoculation in those districts where vaccination can be had. Madras.

Animal vaccination was carried on during part of the year in the Madras, Guntur, and Tanjore circles, and was to be started in 1884 in other circles. In the Guntur circle animal vaccination was rendered necessary in order to keep up a supply of good lymph, as the people would not allow lymph to be extracted from their children's arms.

Bombay.

In the Bombay Presidency the total vaccinations performed during 1883–84 amounted to 883,839, being an increase of 25,128 on the number of the previous year. Of these 826,965 were primary cases, with a percentage of success of 95·69 against 96·15 in 1882–83. Satisfactory progress continued to be made in the protection of infants. Out of every 100 persons primarily vaccinated there were 60·98 infants, of whom 58·58 were successfully vaccinated. Compared with the results of the previous year this percentage is lower by 0·57, but the decrease is only apparent because the difference between the numbers vaccinated and the successful cases was higher by 0·15 per cent. The protection of infants is further shown by comparing the number successfully operated on with those available for vaccination at the rate of 31 per 1,000 of population, when it is found that 61 per cent. were successfully vaccinated against 59·01 in 1882–83, and a five years' average of 48·86. In Bombay City animal lymph only was used, and in Poona, Broach, Nadiad, Anklesvar, Borsad, Rajkot, and Dhrangadra, both animal and human lymph were in use. Vaccination with animal lymph was also carried on in Bandra, and its introduction into the town of Belgaum and the municipal towns of the Satara Collectorate was under contemplation. In all other places vaccination was carried on with human lymph.

The Compulsory Vaccination Act continues to work fairly in Bombay City, and also in the town of Karachi. With the view of encouraging good work amongst vaccinators, steps were being taken to introduce a system of remuneration to the most deserving officers. A scheme was under consideration for forming a class for instruction in vaccination at Karachi.

Punjab.

The statistics of vaccination in the Punjab for 1883–84 testify to the energy shown in the cause by the authorities. The aggregate number of operations performed during the year was 633,062, being an increase of 133,365 over the number of the previous year. Primary operations numbered 624,873, of which 94·25 per cent. were successful against 95·11 in the previous year. Of the 588,761 successful primary cases, about two-thirds (426,253) were infants under one year of age, and 152,034 were children between the ages of one and six years. The number of persons successfully vaccinated during 1883–84 per 1,000 of population was 31·08, or 6·01 higher than in 1882–83; and of children born during the year 58 per cent. were protected by vaccination. Out of 32 districts all but seven showed an increase in vaccinations, but in three the decrease was very trifling. The increase was most marked in Kangra (13,598), and Hoshiarpur (8,228); in four others the increase ranged from 7,578 to 6,573. The increase in the several districts is considered a hopeful sign of the growing popularity of the re-organised vaccination scheme instituted in 1881. "It is also "evident," the Lieutenant-Governor states, "that the advantages of vaccination are beginning "to be felt, and that the prejudices against it are gradually giving way." Two facts alone point to this conclusion, viz., the Amritsar Municipal Committee renewed their application for vaccination to be made compulsory, which was sanctioned; and the application by the Raja of Bashahr for the services of a large staff of vaccinators to carry on operations in his State.

North-Western Provinces and Oudh.

The statistics of vaccination for the North-Western Provinces and Oudh for 1883 indicate a lower degree of success than in previous years; but this is accounted for chiefly by the discontinuance of a system that had been prevalent in Oudh of making fictitious entries. The total operations performed during the year amounted to 649,067, being 23,576 less than the number of 1882. Of these 565,351 or 92·11 per cent. were successful primary cases, less than a half (264,496) being children under one year of age, representing less than 15 per cent. of the registered births. "It is not difficult to see," the Army Sanitary Commission observe, "where "the defects of the vaccination are to be found, and where a remedy has to be applied so "far as it might by itself lessen liability to small-pox, and this lies in directing the work of "the service as much as possible to the protection of infants under the first year of life, "when small-pox is most fatal, and when the protection, once secured, passes onwards to "after life."

The province is divided into three vaccination circles. In the first, comprising the 13 districts of the Agra and Meerut divisions, there was a considerable increase in the number of operations, the successful primary vaccinations having risen from 192,369 in 1882 to 216,044, showing an increase of 23,675, which was spread over all the districts excepting Mainpuri and Muzaffarnagar, where there was a slight decrease. In the second circle, comprising the Oudh, Rohilcund, and Kumaun divisions, there was a most unsatisfactory decrease in the successful primary vaccinations from 164,377 in 1882 to 128,000. This shows a decrease of 36,377 cases, which was spread over all the 22 districts contained in this circle but one, Bara Banki, where the number rose from 2,561 to 5,699. In the third circle, embracing the Allahabad, Benares, and Jhansi divisions, there was also a decrease of 20,853 successful primary cases, the total number for the year being 221,307 against 242,160 in 1882. This decrease was spread over 12 of the total 16 districts, but chiefly in the

Cawnpore and Muzaffarnagar districts, the former showing a decrease of 8,856, and the latter 5,818; the decrease is attributed in some places to paucity of subjects, and in others to want of encouragement on the part of the local authorities. On the whole, however, considerable assistance appears to have been rendered by the local authorities and private gentlemen in extending vaccination.

Central Provinces.

Vaccination work in the Central Provinces during 1883–84 was not attended with such satisfactory results as in the previous year, the total number of operations having declined from 433,691 to 421,542, showing a decrease of 12,149. Of primary vaccinations 409,636 were performed, of which 97·19 per cent. were successful against 96·94 in 1882–83. Out of 357,864 children born during the year, 177,429 were protected by vaccination, or at the rate of 49½ per cent. Eleven districts out of 18 showed a decided falling off in primary vaccination, and in one, Chanda, the decrease was small. The most marked decrease was in Balaghat, where the number fell from 18,068 to 9,492, which the Civil Surgeon attributed "not so much to a failure to vaccinate the children under one year available this season, as "to a larger number of children over one year having been vaccinated last, leaving fewer of "that age available this." Six districts showed an increase in primary cases, the largest being in Sambalpur, where they rose from 21,670 to 27,392. During his cold weather tour the Sanitary Commissioner inspected a number of vaccinated children, and in two circles he found that the vaccinators had almost entirely neglected their work. "The points," he says, "that appeared to me most calling for attention by civil surgeons are, that any cicatrix if "well marked was considered by many vaccinators evidence of successful vaccination, they "not distinguishing between the typical cicatrix and that caused by ulceration; and, secondly, "that sufficient attention is not paid to the number of vesicles or marks, but that one or two "small vesicles or marks are not infrequently accepted as proof of successful, that is, "protective vaccination. Thus parents are led to believe that their children are protected "when they are really not, and an attack of small-pox causes them and their friends to lose "faith in vaccination."

Berar.

The results of vaccination in Berar during 1883–84 show a very considerable decrease, amounting to 2½ per cent. in the number of operations, as compared with the previous year. This serious decrease was attributed partly to the introduction of a new system of organizing the department, whereby the number of vaccinators has been tentatively reduced from 54 to 42, while they are kept at work for 10 months of the year instead of for only six months as heretofore; and partly to the paucity of subjects due to the exceptionally high mortality among children. The total number of operations performed was 86,721 against 110,786 in 1882–83, and the primary cases numbered 86,471, of which 92·69 were successful, a higher rate by 1·1 per cent. than in 1882–83. But although there was such a falling off in the number of operations, satisfactory progress was made by the Vaccination Department in infantile vaccination, no less than 70¼ per cent. of the total successful cases being infants under one year of age against 61·3 in the previous year. Estimating the births at 40 per 1,000 of population, the number of infants successfully vaccinated during the year was 53·09 per cent. There appears to be but little opposition to vaccination; the people are, however, apathetic, and a little pressure is sometimes necessary to make them bring up their children for vaccination. In some of the larger towns much difficulty is experienced amongst Marwadis and Mahomedans, and the only remedy, in the opinion of the Superintendent of Vaccination, is the extension of the provisions of the Vaccination Act to Berar. Municipalities were invited to consider the question of compulsory vaccination, and the committees of Khamgaon, Shegaon, Akola, and Basim passed resolutions for the introduction of a bye-law making vaccination compulsory within their limits. The matter was still under consideration in the municipalities of Amraoti and Ellichpur.

Assam.

Great progress was made in vaccination work in Assam during 1883–84. The total operations numbered 88,693, which is an increase of 30,854 on the number of the previous year, and of 43,447 on that of 1881–82, when first a marked improvement manifested itself. With the exception of 570 cases all the operations were primary, and of these 76,368 or 86·66 per cent. were returned as successful. All the districts showed an increase except Darrang, where there was a falling off by 3,522 cases. In the tea gardens considerable advance was made, the total operations having increased from 2,243 in 1882–83 to 10,336; but of these only 51·2 per cent. were successful. Of the total successful primary cases, 12,035 were infants under one year, and 39,820 were children between one and six years of age. The protection afforded to children born during the year was in the proportion of 11 per cent. No active opposition to vaccination is shown by the people generally, but it would appear that religious prejudices, especially among the higher classes,

interfere with the spread of the cause. "The influence of the Goshains and other heads of "religious establishments," it is stated in the Resolution of the Local Government on the Vaccination Report for 1883-84, "is a factor in the social and moral life of the Assamese "which has never been thoroughly fathomed or properly understood, and the whole of that "influence (with very few exceptions) is directed against vaccination. . . . Large sections "of the community are, no doubt, free from this religious subjection, and it is among them "that vaccination makes progress; but among the classes higher in the social scale it can "make little advance till some means are found of diverting the opposition of the Goshains, "or till the superstitious veneration in which they are held melts away."

British Burma.

Some progress was made in the work of vaccination in British Burma during 1883-84. The total number of operations performed by the vaccination staff was 73,269, or 18,174 more than in the previous year. Of these 61,901, or 84·48 per cent., were successful cases against a percentage of 84·11 in 1882-83. According to age only 8,831 of the successful cases were infants under one year of age, representing about one-ninth of the registered births; while 33,220 cases were between one and six years. At the dispensaries only 28 operations were performed, 17 being successful. The Sanitary Commissioner complains that the influence of the medical officers in charge of these institutions for the advancement of vaccination is very far from being utilised; the Government of India have therefore directed that civil surgeons should be enjoined to devote special attention to the matter. Much good work, however, appears to have been done by independent vaccinators. Possibly, the Chief Commissioner observes, the total of such outside operations may have been 20,000. Under the direction of one gentleman (the Rev. Dr. Vinton, an American missionary) over 8,000 Karens were reported to have been successfully vaccinated.

VI.—MEDICAL INSTITUTIONS.

Civil Hospitals and Dispensaries.

Considerable changes were made during 1883 in the administration of charitable dispensaries in Bengal. A large number of these institutions was transferred to the management of municipalities, new ones were opened, and others which had been closed as useless or for financial reasons were re-opened. The old system, under which Government guaranteed an appointment as assistant surgeon to every student passing the licentiates' examination, was found to cause an accumulation of unemployed assistant surgeons, and was brought to an end. For the purpose of adjusting the pay of medical officers at sub-divisions, all sub-divisions were graded in seven classes, according to the work in each, and arrangements made for posting to them medical officers from the grade of surgeon for the highest class to that of assistant surgeon for the intermediate, and of hospital assistant for the lowest class of sub-division. The managers of dispensaries are allowed to utilise the services of the sub-divisional medical officers on payment of the dispensary allowances, or to secure the services of an officer of a higher grade on making up the difference of the grade pay and allowances. At the close of 1882 the number of dispensaries that remained open was 223. In the course of 1883 11 institutions were newly established, and four were closed or abolished, leaving 230 open at the close of the year. Of these 102 were managed by municipal bodies, and 101 by special committees. The total number of patients under treatment was 938,221 against 957,623 in 1882; of in-patients there were 22,468 and of out-patients 915,753 against 23,468 and 934,155 respectively in the previous year. The death-rate among the in-patients was 141·3 per 1,000, less by 16·2 per 1,000 than in 1882, and lower than in any of the previous six years. Bengal.

The charitable dispensaries do not appear to be largely resorted to by the people even in times of epidemics. The value of European medical science is, however, becoming more felt, and it is hoped that as local bodies interest themselves more in the management of the dispensaries the people may be brought to place more confidence in them.

The income of the institutions in 1883 amounted to 45,175*l.*, of which 3,951*l.* were contributed by Government, and 13,375*l.* were subscriptions from Europeans and Natives, those of the latter amounting to 11,571*l.*; the remainder was made up chiefly of municipal and other local funds. The expenditure of the year, including 1,747*l.* invested, was 37,781*l.*, and the cash balance at the end of the year was 7,393*l.*

Although, on the whole, the health of Calcutta in 1883 was more satisfactory than in the previous year, the evidence of the hospitals was not in accord with that of the general town record. The total number of patients rose from 253,083 in 1882 to 259,718, an increase of 6,635. The increase, however, was entirely among out-patients, as shown in the following table, and was attributed to the fact that cases of lighter illness were more common during the year.

Medical Institutions.	1883.				1882.			
	Total Treated.			Died per 1,000 of treated.	Total Treated.			Died per 1,000 of treated.
	In-door.	Out-door.	Total.		In-door.	Out-door.	Total.	
Medical College Hospital	5,541	51,022	56,563	112·03*	5,448	39,329	44,777	123·5
General Hospital	3,121	—	3,121	47·7	3,295	—	3,295	44·91
Mayo Hospital and Dispensary	2,212	176,619	178,831	164·5	2,125	182,163	184,288	173·84
Campbell Hospital	5,469	—	5,469	234·04	5,669	—	5,669	247·83
Municipal Police Hospital	2,377	—	2,377	11·7	2,438	—	2,438	13·53
Total Calcutta Hospitals	18,750	227,641	246,391	131·13	18,975	221,492	240,467	138·89*
Howrah General Hospital	1,631	11,696	13,327	200·4	1,604	11,012	12,616	199·5
Grand Total	20,381	239,337	259,718	136·83	20,579	232,504	253,083	143·73

* Reckoned on the cases treated, exclusive of ophthalmic cases.

Among the in-patients there were 2,719 deaths, or 136·83 per 1,000, a lower rate than in any of the previous seven years, and this notwithstanding that the number of cholera cases treated in 1883 was larger, and the disease was attended with full measure of fatality. Excluding cholera, the death-rate was 116 per 1,000, lower than in any year since 1876. Of the chief diseases among in-patients there were 932 cholera cases, 510 of which proved fatal; fever cases numbered 3,843, and the deaths 299; from small-pox there were 111 cases and 35 deaths; and for dysentery and diarrhœa 2,428 patients were treated, of whom 734 died. Of other diseases phthisis accounted for 192 deaths, and respiratory affections 151. It will thus be seen that these six causes accounted for more than two-thirds of the total mortality. In major surgical operations there was an increase of 160, compared with the results of

1882, the total number performed being 1,160. Including the cases under treatment from the previous year the number was 1,253. Of these 786 were cured, 213 were relieved, 61 were otherwise discharged, and 108 ended in death. The number of minor operations performed during the year was 15,873 against 17,707 in 1882.

The total income of the Calcutta hospitals in 1883 amounted to 43,170*l.*, of which Government contributed 26,232*l.*, and the total expenditure for the year was 40,870*l.*

Madras. The number of hospitals and dispensaries in the Madras Presidency increased in 1883 by 12, the total being 287 against 275 in 1882. Of these only 18 were State institutions, constituting the first class; 255 were local fund and municipal institutions, or second class; while 14 others were private institutions, 8 being aided by Government or local bodies. The total number of patients under treatment during the year was 1,696,809, being an increase of 158,233 on the number of the previous year. More than a third of the total number of patients were females. "If the conservative habits of the people be taken into "consideration," the Surgeon-General remarks, "it must be gratifying to see European "medicine making such steady and increasing progress amongst the female portion of the "population; and if the amount of private practice of medical officers amongst the more "respectable Hindu families, who do not usually apply at public hospitals, be added, the "proportion would be found to be still more satisfactory." The increase was, as usual, chiefly among out-patients, the in-patients having risen only from 37,456 to 38,447. Of these 2,903 or 75·5 per 1,000 died during the year against a mortality of 71·6 in 1882. As already shown the public health was not satisfactory. Cholera was epidemic more or less throughout the southern parts of the Presidency, and the cases treated at the dispensaries rose from 10,131 in the previous year to 10,384 in 1883; of these 452 were in-patients, of whom 239 died. Small-pox patients increased, while cases of venereal diseases and malarial fever were not so numerous as in former years; on the other hand there was a considerable increase in skin diseases and ulcers. Surgical operations again showed a decided advance, those of a major kind having risen from 2,811 in 1882 to 3,262, and the minor operations from 39,405 to 45,918. These gratifying proofs of native confidence in operative surgery are due in a great measure, the Surgeon-General points out, to the dispensaries being "now to a larger "extent under the management of men practically qualified in the several branches of "their profession, and the number of surgical operations is the result of employing more "largely the class of civil apothecaries, instead of hospital assistants, for the charge of local "fund hospitals."

The total income of the institutions declined from 81,106*l.* in 1882 to 80,354*l.* of which 28,864*l.* represented contributions from Government. Native donations and subscriptions fell from 1,783*l.* to 1,138*l.*

Bombay. During 1883 four new dispensaries were opened in the Bombay Presidency and one was closed; at the end of the year there were 202 institutions in operation against 199 in 1882. The total number of patients under treatment was 1,372,249, of whom 36,255 were in-patients and 1,335,994 out-patients against 35,111 and 1,285,074 respectively in 1882. There was thus an increase of 1,144 in the number of the former class of patients and of 50,920 in the latter in 1883. Of the in-patients 24,801 were cured, 3,099 were relieved, 2,979 were otherwise discharged, and 2,559 or 70 per 1,000 died against a ratio of 71 per 1,000 in the previous year. Malarious fevers, as usual, were the chief causes of admission, being in the proportion of 18·3 per cent. of the total treated for all diseases against 19·2 in 1882; skin diseases came next with a percentage of 12·8 against 12·3; diseases of the eye followed with 9·4; worms 7·6 against 7·2; and respiratory diseases 5·6 against 5·2. Cholera cases rose from 2,520 in the preceding year to 6,215, of which 5,083 were treated in the Deccan, where the disease was most prevalent during the year; 605 in the Konkan, and 527 in Gujarat. Of small-pox there were 845 cases treated against 128 in the previous year. The figures for cholera and small-pox, however, in no way represent the actual extent of these diseases, as all the cases are not taken to hospitals and dispensaries for treatment.

In surgical operations there was an increase of 7,428, the total number being 79,815 against 72,387 in 1882. The increase, however, was entirely under minor operations, and was due to the fact that many of the operations heretofore entered as major were classed as minor in 1883. The number of major operations performed during the year was 4,393, which added to the 147 under treatment at the beginning of the year gives a total of 4,540 against 4,571. Of these 3,918 were discharged as cured, 152 were relieved, and 179 died.

The net income of the institutions for 1883 amounted to 98,177*l.* against 96,587*l.* in 1882. Of this sum 77,897*l.* were contributed by Government, and 17,950*l.* were from local and municipal funds, while the receipts from private subscriptions amounted to only 846*l.* against

1,758*l.* in 1882. The attention of Collectors has been directed to the expediency of inducing the public to subscribe more liberally towards the support of dispensaries. The total expenditure, exclusive of 1,660*l.* invested during the year, amounted to 92,329*l.* against 90,306*l.* in the previous year.

Punjab.

The year 1882 closed with 189 dispensaries at work in the Punjab. During 1883 four new institutions were opened and two were closed; there were therefore 191 open at the close of the year. At these 38,016 in-patients and 1,560,240 out-patients were treated against 38,619 and 1,578,405 respectively in 1882, showing a decrease among both classes of 18,768. The decrease, however, was viewed with satisfaction, as it was attributed to the general healthiness of the year. Of the more important diseases under treatment, malarious fever cases numbered 269,254, or less by 84,447 than in 1882, the largest decrease being in the districts which had previously suffered so severely from inundations; ulcers formed the most numerous class of patients after fevers, followed by respiratory diseases, both showing a considerable increase compared with the previous year. As in previous years ophthalmia prevailed to a great extent, and would appear to be steadily increasing. The matter was receiving special attention, and civil surgeons of districts where ophthalmia was prevalent were invited to offer an opinion on the subject. The number of cases rose from 90,320 in 1881 to 113,789 in 1882, and to 115,207 in 1883. Of small-pox cases there were 245, and of cholera 113; of the latter 103 were fatal. Among the in-patients there were 2,041 deaths, the ratio per 1,000 of total treated being 53·7 against 56·0 in 1882. A striking proof of the usefulness and popularity of the Punjab dispensaries is the increase in the number of surgical operations which rose from 107,216 in 1882 to 121,895 in 1883. Of these 6,646 were of the major kind, an increase of 1,499 on the number for 1882. The Surgeon-General testifies to the satisfactory working of the hospitals and dispensaries as a whole. Excellent work is reported to have been done at the Mayo and Egerton hospitals; the latter is said to be popular, not only among the inhabitants of the city of Peshawar in which it is situated, and surrounding territory, but also beyond the border, a number of Afghans having applied for relief during the year.

The income from all sources amounted to 44,667*l.* against 37,771*l.* in 1882, of which 35,680*l.* were derived from local and other funds. The expenditure amounted to 44,261*l.* against 36,111*l.*

North-Western Provinces and Oudh.

The number of hospitals and dispensaries in the North-Western Provinces and Oudh for which statistics were furnished in 1883 was 212; of these 202 were supported by provincial and local funds, and 10 were chiefly supported by private individuals, but aided by provincial funds; besides these, 22 institutions, supported entirely by private individuals, were at work during the year, the results of which are not given. The returns of the 212 institutions showed that 1,525,172 patients sought out-door relief, a decrease of 128,295 on the number of 1882; and that 42,284 were in-door patients, a decline of 1,347 on the number of the previous year. The causes assigned for the decrease was the exceptionally healthy character of the year and the more faithful record of cases treated. Of the total patients 2,148 or 0·14 per cent. were under treatment for cholera, 13·11 per cent. for fevers, 19·89 for skin diseases, 6·48 for respiratory affections, 5·36 for rheumatism, 5·75 for ophthalmia, and 4·48 for dysentery and diarrhœa. The deaths among the in-patients fell from 3,360 or 77 per 1,000 of the total number in 1882 to 2,549 or 60 per 1,000 in 1883. The progress in surgery continued to be satisfactory. Altogether 91,371 operations were performed, of which 12,968 were major against 10,613 in 1882, and 78,403 were minor against 76,492. Of the major operations 4,882 were cataract cases, and of these 3,346 proved successful, the patients acquiring good sight.

Excluding balances, the total dispensary income of 1883 was 37,844*l.* against 40,299*l.* The amount contributed by Government fell from 17,186*l.* to 1,044*l.*, the decrease resulting from the transference of the control of the majority of the institutions from the State to local bodies. The expenditure amounted to 39,431*l.* against 38,511*l.* in 1882.

Central Provinces.

The number of charitable dispensaries open in the Central Provinces during 1883 remained the same as in the previous year, viz., 82, all being practically maintained by local funds. The number of cases treated was 611,541, an increase of 18,698 on the total of the previous year; the increase was solely under out-patients, in-patients having decreased from 7,895 in 1882 to 7,545. The decrease in in-patients was consequent on a more careful and discriminate selection of cases. The most prominent diseases under treatment were fevers, but there was a decrease of 872 cases on the number of the previous year; in cholera cases there was an increase of 984; and there was a marked increase under all the more common diseases. In cases of ophthalmia there was the very large decrease of 8,321, while in 1882 the cases were 17,221 in excess of the number of 1881. Each year witnesses to an increase in surgical

operations, the major kind were 143 above the number performed in 1882, and the minor class 1,564 in excess. The deaths among the in-patients numbered 824 or 109·2 per 1,000 of total treated against a ratio of 121·0 in the previous year. On the whole the results of the year were considered satisfactory; and dispensary treatment appears to be gaining in popularity among women; it is reported that women and children now resort to dispensaries in increasing numbers.

The total receipts of the institutions during 1883 amounted to 11,671*l.*, of which Government contributed 4,479*l.*; the expenditure was 11,185*l.*

Berar.

There was an addition of five new dispensaries to the 36 open in 1882, making a total of 41 at work during 1883. At these 195,364 persons sought relief, which is an increase of 14,354 on the number of the previous year. In-patients numbered 2,137, or 46 more than in 1882. The year being an extremely unhealthy one a general increase in attendance at the dispensaries was anticipated, but except in a few institutions it was inconsiderable. As already stated, cholera was very prevalent in the province in 1883, and much good work appears have been done in the way of relief. In all there were 4,697 cases under treatment against 783 in the previous year. Further relief was also provided by a special staff of additional medical officers dispersed through the villages where the disease was most rife. Amongst in-door patients fevers, injuries, dysentery, rheumatic and chest affections, diarrhœa, abcess, and ophthalmia were the principal causes of admission, and excepting injuries and rheumatic affections, these also constituted the chief diseases for which out-patients were treated. There were 106 deaths among in-patients, being in the proportion of 49 per 1,000 of the total number against a ratio of 52 per 1,000 in 1882. As regards operations, the results of the year were satisfactory. The number performed was 291 major and 7,060 minor operations as compared with 266 and 7,546 respectively in the year previous.

The income of the institutions for the year, excluding the opening balance, amounted to 10,527*l.* against 10,841*l.* in 1882. The income was materially augmented by the large increase of 643*l.* in subscriptions and donations from Natives; on the other hand there was a falling off of 730*l.* in the amount received from local funds. Of the total receipts 7,673*l.* were contributed by Government. The expenditure, excluding sums invested, amounted to 8,962*l.* against 9,526*l.* in the previous year.

Assam.

There were 29 dispensaries working in Assam during 1883; four only, in the hill districts, were supported by Government, and two were managed entirely by private persons, with a small contribution from Government, while the remaining 23 were supported by local boards. Several others were also opened by the local boards in the Sylhet district, but they were hardly in working order by the end of 1883. These new institutions are mainly supported by local funds, but in some the Government had agreed to appoint a hospital assistant, while others were to receive European medicines free of cost. The number of patients treated during 1883 amounted to 77,560, of whom 3,294 were in-door and 74,266 out-door patients against 3,229 and 61,523 respectively in 1882; there was therefore a total increase in the year under notice of 12,808 patients. Fevers and skin diseases were the principal diseases treated, but want appears to have been at the bottom of most illness, and generous diet is reported to have done more for the patients than medicines. The number of deaths among the in-patients rose from 589 or 182·4 per 1,000 in 1882 to 666 or 202·2 in the year under report. The total number of operations performed during 1883 was 2,472 against 2,463 in the previous year. Of these 148 were major operations, being an increase of 4 on the number of 1882. The Sanitary Commissioner considered that operative surgery in the various dispensaries would be greatly increased if the dispensaries themselves were, as a rule, more suited to receive surgical cases. "It too often happens," he states, "that the surgical relief "of a district falls into disuse, and even into disrepute, through the simple fact that the "dispensary wards and their occupants are in such an insanitary condition that the "superintendents are justified in refusing operative cases." The Chief Commissioner directed the attention of the authorities to this matter, and hoped that they would introduce such reforms that the Sanitary Commissioner might not have to record so unfavourable an opinion in his next report.

The total income of the institutions amounted to 5,632*l.* against 4,351*l.* in 1882; and the expenditure, exclusive of sums invested, was 5,257*l.* against 3,927*l.* One satisfactory feature in the year's receipts was the increase in subscriptions from Europeans and Natives from 1,281*l.* to 1,501*l.*

British Burma.

Each year testifies to the popularity and usefulness of the hospitals and dispensaries in the province of British Burma. The number of these institutions open in 1883 was 28, the

same as in the previous year, but the number of patients under treatment increased from 134,176 to 151,073. Of these 137,641 were out-patients and 13,432 were in-patients. Nearly half the total number were natives of India, a circumstance which is attributed to the fact that, with one exception, all the hospital assistants are natives of India, most of them being very imperfectly acquainted with the Burmese language, and that the medical officers in charge of districts are all either Europeans or natives of India. Efforts, however, were being made to train Burmans to fill these appointments. With this object six students were studying in Calcutta for the assistant surgeon grade, and six pupils, candidates for appointment to the hospital assistant grade, were under training in Madras. In the event of this experiment proving successful a wider appreciation of the advantage of the European system of medicine is anticipated among the natives of Burma. During the year 329 major and 3,863 minor operations were performed against 193 and 3,128 respectively in 1882. It is satisfactory also to note that the obstetric cases rose from 152 in 1882 to 212 in 1883. Of the 13,432 in-patients 7,918 were cured, 827 relieved, 528 otherwise discharged, and 1,197 or nearly 90 per 1,000 died. In several of the hospitals considerable improvements were effected during the year, and four new dispensaries were in course of construction.

Lock Hospitals.

In the exercise of the discretion granted by the Secretary of State, the Government of India ordered the suspension in Calcutta of the Contagious Diseases Act from the 15th March 1883; arrangements were, however, made through the Surgeon-General for maintaining the lock hospitals at Alipore and Sealdah for the treatment of venereal disease as purely voluntary institutions. The results of the first year's working of these two hospitals on this basis show that on the day previous to the suspension of the Act there were 146 Native women under treatment in the Alipore and six in the Sealdah hospital. The day following the suspension of the Act all but five of the women in the former hospital demanded to be discharged and were set free; while in the latter every woman remained voluntarily until she was cured. It is stated that the scare among the Native women was due to a report by some evil-disposed person that those women who remained voluntarily in the hospitals would not be allowed to leave even when cured. Only by degrees was the true nature of these voluntary hospitals learnt by the Native women. The daily monthly average of attendance in the hospitals increased from 6·9 in April to 58·8 in August, and then fluctuated from 42·5 in October to 52·4 in December. Bengal.

The Surgeon-General (Dr. Payne), when subsequently reporting on the results of the above measure during the remainder of 1883, expressed his most decided opinion against the policy of withdrawal, stating that the measure had in the course of nine months undone all the good that had been accomplished. The statistics furnished by Dr. Payne apparently show that the withdrawal of the Act had resulted in injury to the health of certain classes of the population. On the other hand, as stated in the Resolution of the Bengal Government, "it must be "remembered that other evils which the Native public regard as substantial have been "removed. It would be premature to decide, after an experience of only nine months, "on which side lies the balance of advantage. If, after a sufficiently prolonged experience, "it should appear to the Lieutenant-Governor that the health of the population of Calcutta "and the garrison of Fort William demands the surrender by the women of the town of so "much of their personal liberty as is curtailed by the strict enforcement of the Act, "Mr. Rivers Thomson will not hesitate to bring the matter again under the consideration of "the Government of India."

As regards the working of the four cantonment lock hospitals in Bengal, the results obtained at Barrackpore and Dum Dum were far from satisfactory; while the returns for Darjeeling show a considerable decrease in the number of admissions, and those for Dinapore exhibit a slight improvement.

At Dinapore the total admissions among the troops were 135 or 145·16 per 1,000 of an average strength of 930 against 149 or 162·8 in 1882. The favourable results of 1883 were again attributed to the manner in which the duties of supervision and examination were performed. At the beginning of the year 65 women were on the register, 22 were added in the course of the year, and 18 names were struck off, leaving 69 on the roll at the close of the year. There were altogether 230 admissions among the women, or 62 more than in 1882, the increase being attributed to the prompter and more frequent detection of disease.

Among the troops stationed at Barrackpore, there were 66 cases of venereal disease, being in the proportion of 268·2 per 1,000 of average strength against 241·56 in 1882. Of the total cases 37 were of primary syphilis. It is reported that the Cantonment Committee were of opinion that it was impossible to check venereal disease among the troops at Barrackpore while the Contagious Diseases Act was not in force in Calcutta and Serampore; and that, though clandestine prostitution probably takes place locally, it was difficult to detect it. The

proximity of Calcutta, it is observed in the resolution of the Local Government, no doubt enhances the difficulty of protecting the troops in cantonments, and the consequences of the complete withdrawal of the Contagious Diseases Act are reflected in the returns from Barrackpore and Dum Dum. The average number of women on the register during the year was 29; and the number of admissions to hospital was 72 against 64 in 1882; but only 10 cases were reported as being of a specific infecting character.

At Dum Dum out of an average strength of 763 troops, 282 or 369·59 per 1,000 were admitted to hospital on account of venereal disease against 151·6 in 1882; of these, 156 were for primary syphilis. This great increase was attributed to the infrequency of examination of the registered women and to the probable existence in the neighbourhood of unregistered women. With a view to put down unlicensed prostitution in the cantonment, it was suggested that a special police force should be employed experimentally for one year for the detection of prostitutes; but the Lieutenant-Governor considered that, as the cost of the institution was already too high, it was not advisable to enforce additional expenditure on the fund. The average number of women on the register during the year was 27, and there were 45 admissions among them against 33 in 1882.

The number of admissions of European soldiers into the Jellapahar lock hospital, Darjeeling, was only six out of an average strength of 221, or in the proportion of 27·14 per 1,000 against 111·11 in 1882. Four women were on the register at the beginning of the year; four others were added in the course of the year, and five were struck off, leaving only three on the roll on the 31st December. "These figures," it is remarked, "would seem to point "to the conclusion that unlicensed prostitution is prevalent, but it is difficult to reconcile "the inference with the unusual healthiness of the troops."

Madras.

In the Madras Presidency seven military lock hospitals were in operation, the same number as in the previous year. The average number of women on the register in 1883 was 667. In four stations the number was larger than in the previous year, and less in three. The total number of cases under treatment was 2,611 against 2,372 in 1882. Amongst the troops the ratio of admissions per 1,000 of average strength rose from 257 to 274. In the stations of Bangalore, St. Thomas's Mount, Secunderabad, and Wellington the results of 1883 show an increase in the amount of disease among the soldiers as compared with the previous year. An explanation of this, the Surgeon-General states, is found in the comparatively small number of women on the register in all the stations, and in the fact that the soldier does not confine his attentions to prostitutes under the surveillance of the police.

Bombay.

In the Bombay Presidency lock hospitals were maintained at the same 12 stations as in previous years. Amongst the troops the average rate of admissions into hospital per 1,000 of strength was 8·94 higher than it was in 1882, but the ratio was still less than it was during the immediately preceding five years. There was also considerably less disease in the stations where lock hospitals exist than in those where no such institutions were in force. "From recent evidence," the Surgeon-General, Her Majesty's Forces in the Bombay Command, states, "it would appear to be implied that the chief cause of venereal disease "lies in the illicit prostitution of unlicensed women in the neighbourhood of cantonments. "Increased vigilance of the police has been inculcated, but unless the soldiers themselves "choose to act discreetly in only cohabiting with licensed women, I fear that the meagre "powers with which the police are invested will not diminish these admissions for venereal "disease."

North-Western Provinces and Oudh.

The average number of registered prostitutes on the rolls of the 18 lock hospitals in the North-Western Provinces and Oudh fell from 1,087 in 1882 to 979 in 1883; but, as the average daily strength of the European garrison also fell from 13,291 to 11,471, the proportional strength of women was slightly greater, namely, 8·5 per cent. against 8·1. This, however, was much below the proportion which prevailed in 1879, when there were 12·5 women registered for every 100 soldiers in garrison. Excluding cases remaining in hospital at the opening of the year, 1,187 women were treated for venereal disease against 1,924 in 1882. This decline is the more satisfactory as it represented not merely an actual decrease corresponding with the diminished numbers of women on the registers but a very marked improvement in the proportion of cases to total strength, the percentage of women diseased in 1883 being 121·2 against 177 in 1882.

Notwithstanding the soldier's persistent preference for unregistered women, and the continued decrease in the number of unregistered women, the results of the working of the lock hospital system in the provinces were, on the whole, satisfactory. The number of soldiers admitted to hospital on account of venereal diseases was 2,704, or in the proportion of 235·7 per 1,000 against 263·7 in the previous year. The improvement was most conspicuous at Benares, Chakrata, Ranikhet, and Lucknow; while, on the other hand, the

returns were less favourable at Agra and Fyzabad, a result due partly to the movements of troops affording opportunities for intercourse with unregistered women, and partly to the want of a sufficient supply of registered women. It is reported that the venereal disease prevailing in the province is of a much milder type than that contracted by soldiers in England.

Central Provinces.

There are four lock hospitals in the Central Provinces, viz., at Kamptee, Saugor, Jubbulpore, and Pachmarhi. With the exception of Saugor the hospital returns show a decrease in the number of men admitted into hospital. At Pachmarhi the depôt troops numbered only 73, and among them there were but four admissions, or 54·78 per 1,000, against 10, or 97·08, in 1882; at Kamptee the admissions among the troops were in the proportion of 126 per 1,000 of average strength against 156; at Saugor the admission rate was 293 against 284 per 1,000, and at Jubbulpore there was a marked decrease, the admissions having fallen from 463 per 1,000 to 261. The average number of women on the registers was 157 against 185 in 1882, and the number of cases of disease and admissions into hospital among them was 318 against 400. Only at Pachmarhi were the admissions among prostitutes in excess of the number of the previous year.

British Burma.

The statistics of the six lock hospitals in British Burma for 1883 show that the average number of women on the register was 658 against 580 in 1882, and that amongst them there were 1,228 admissions to hospital on account of venereal diseases as compared with 1,083 in the previous year. Three out of the six hospitals, viz., Rangoon, Thayetmyo, and Toungoo, are regulated by rules made under the Cantonment Act, 1880, and are kept up chiefly for the benefit of the European garrison; while the Moulmein, Bassein, and Akyab hospitals are maintained for the benefit alleged to be derived from them by sailors visiting those ports. Of an average strength of 1,880 garrison troops the admissions for venereal diseases were in the proportion of 168·51 per 1,000. Compared with the previous year, Rangoon and Thayetmyo showed an improvement, but at Toungoo the admissions rose from 222·44 per 1,000 of average strength to 268·44. It is noticed in the Government Resolution on the Report for 1883 that "during the past five years, in the towns where lock hospitals "have been maintained, venereal diseases have increased in frequency among the European "troops, and apparently also among the general population. Whether the increase would "have been more rapid if the lock hospitals had not been maintained, or whether it would "have been less rapid if the rules had been more strictly enforced, it is impossible to say; "but it must be admitted that the statistics fail to show that any advantage has been derived "from the enforcement of the rules." Since the close of the year under notice the lock hospital at Moulmein has, at the wish of the Municipal Committee, been closed.

Lunatic Asylums.

Bengal.

At the five lunatic asylums in Bengal there were 1,081 patients under treatment during 1883, or 25 more than in 1882. In the course of the year 90 of the number were discharged as cured against 83 in the previous year, but the number of persons transferred to friends in an improved condition fell from 34 to 27; five were otherwise discharged, and 52 died, the smallest number on record, leaving 907 still under treatment at the end of the year against 849 in 1882. Out of the 232 cases admitted and re-admitted during the year the causes of insanity were unknown in 98; and of the cases in which causes were assigned, 108 were ascribed to physical and 26 to moral causes. In commenting on intoxication as a prevalent cause of insanity, the Surgeon-General makes the following remarks: "I have said before that "occurrences in the asylums show that the statements on this point are below—I might say "very much below—the truth, and that, on the other hand, resort to intoxication is sometimes "assigned as the cause of a derangement of which it is only an early result. There were in "all 76 admissions from ganja and bhang in 1883, and only 34 recoveries. If the cases were "rightly ascribed, the proportion was small, and again proves that, with increased admis-"sions, there was no increase of cases of mere temporary intoxication among them." The health of patients was very satisfactory in all the asylums, the admissions to hospital numbering only 235 against 394 in 1882 and 385 in 1881. Of the total cases under treatment, 4 were of cholera against 15 in 1882; fever cases fell from 108 to 46; dysentery from 82 to 34; and among the other principal diseases there was a decrease except in phthisis, from which the admissions rose from 23 to 26. The largest number of deaths was from phthisis, viz., 13; from cholera there were 2 deaths, from apoplexy 6, from diarrhœa 5, from dysentery 4, and from fevers 3. The low mortality from zymotic diseases is evidence of the efficiency of the sanitary arrangements in the asylums.

Of criminal lunatics there were 423 under treatment during the year against 384 in 1882, the primary admissions numbering 93 and re-admissions 12. The discharges as cured and tranfers rose from 41 to 50, and the deaths fell from 25 to 14; there were thus 359 still under treatment at the close of the year.

As regards the European asylum at Bhowanipore, 51 patients were under treatment, 24 of whom were admitted in 1883 against 20 in 1882. Of the total number, 3 were discharged as cured, 10 were deported to Europe under the Merchant Shipping Act or otherwise, 8 were transferred to the care of friends, and one died.

Madras. The statistics of the three lunatic asylums in the Madras Presidency for 1883–84 show that 652 patients of all classes were under treatment during that year against 617 in the previous year. The fresh admissions numbered 218, or two less than in 1882, of whom 36 were criminal lunatics against 43. At the close of the year there remained 493 patients under treatment (of whom 102 were of the criminal class), 98 having left the asylums as cured, 29 transferred to friends, 8 otherwise discharged, and 26 died, 2 being criminal lunatics. The returns exhibiting the causes of insanity in the patients in the various asylums show that the probable cause, in the majority of cases, is the abuse of narcotic drugs; but it is again reported that it is impossible in the greater number of cases to obtain any accurate account of the antecedent history of the patients. The general health of the inmates of the asylums was very favourable, and the mortality was only 50·5 per 1,000 of daily average strength.

Although small-pox and cholera were prevalent in Madras City during the year, they did not visit the Madras Asylum; in fact, no epidemic disease was present at any of the asylums.

It is reported that the majority of the patients are received in feeble health, and that they generally improve under the course of food obtained in the asylums.

Bombay. Although accommodation in the asylums of the Bombay Presidency was not so pressingly felt as in the previous year, it was still inadequate in four of the five asylums, consequently admissions had occasionally to be refused until vacancies occurred. The new asylum at Ratnagiri, which was still in course of construction, will relieve the pressure felt at the existing institutions; but as it appears to be making slow progress the attention of the Public Works Department has been invited to the matter, with a view to the speedy completion of the institution. The total number of patients under treatment during 1883 was 948 against 931 in 1882, of whom 812 were new admissions and 17 were re-admissions. In the course of the year 259 were discharged, 99 being sent away as cured, 160 transferred to the care of friends, and 79 died, or 27 in excess of the mortality of 1882. Of criminal lunatics there were 107 under treatment, being 5 more than in the previous year, and of these 15 were discharged, 10 died, and 82 remained at the close of the year. The alleged causes of insanity were known only among half the total 948 insanes; in 389 cases insanity was ascribed to physical causes, such as the use of *ganja*, spirits, and opium, and certain forms of disease, and in 85 cases insanity was attributed to moral causes, chiefly grief. The general health of the patients was fairly satisfactory, and there was no epidemic or extraordinary amount of sickness in any of the institutions; the patients suffered chiefly from debility, diarrhœa, epilepsy, dysentery, and fevers. Most of the deaths occurred amongst old and debilitated patients.

Punjab. At the two lunatic asylums in the Punjab (Lahore and Delhi) the total population in 1883, including 51 criminal lunatics, was 479, or 26 in excess of the previous year. Of these 143 were fresh admissions, 12 belonging to the criminal class. From both asylums 78 lunatics were discharged during the year, 31 as cured. The year was a remarkably healthy one, and there was no epidemic of any kind in either asylum. Fever formed the most frequent cause of admission to hospital. The deaths were 23 at Lahore and 8 at Delhi, equal to 80·9 and 95·9 per 1,000 of average strength respectively against 87·7 and 131·0 in the previous year; but at both asylums the average strength was greater than in 1882.

North-Western Provinces and Oudh. The number of lunatics under treatment in the four asylums of the North-Western Provinces and Oudh rose from 1,163 to 1,205, of whom 336 were fresh cases. At the end of the year the population of the asylums stood at 915, 218 having been discharged and 72 having died. Of the four asylums the mortality was again highest at Lucknow (143·5 per 1,000 of average strength), and lowest at Agra (47·2). "To some extent," it is reported, "this result was accidental, the Lucknow asylum having been particularly unfortunate in "having had a number of deaths from brain diseases, and in receiving a number of weak and "sickly patients; but there was reason for believing that the attention paid to the diet of the "insanes at Agra had had a good effect on the health returns of that asylum, and that

"especially the immunity of the inmates from bowel complaints was due to the care given to "the issue of vegetable acids continuously in the diet." At the other two asylums, Bareilly and Benares, the death-rates were 64·0 and 86·4 per 1,000 respectively.

Criminal lunatics appear to be steadily increasing. The number in 1883 being 196, as compared with 167 in 1882 and a 10 years' average of 142.

Central Provinces.

The aggregate number of patients under treatment at the two lunatic asylums in the Central Provinces during 1883 was 297, of whom 129 were confined in the asylum at Nagpur, and 168 in that at Jubbulpore. The proportion of cases cured was unusually small at Nagpur, being only 5 against 8 in the previous year, while at Jubbulpore the number discharged as cured was unusually large, 20 against 4 in 1882. "Mania," the Deputy Surgeon-General of the Provinces reports, "including both the acute and chronic forms, was "the type under which by far the largest number of patients admitted in 1883 was "suffering, as is, I think, the case in most Indian asylums; a large number of these cases "being really cases of poisoning by ganja or other preparation of Indian hemp." At Jubbulpore the lunatics appear to have enjoyed very good health, but at Nagpur fever and dysentery and diarrhœa were very prevalent. Altogether there were 10 deaths in the asylums, Nagpur contributing 4, the same number as in 1882, and Jubbulpore 6, against 4 in the previous year.

Berar.

At the Amraoti lunatic asylum in Berar 32 insanes were under treatment in 1883, of whom 9 were criminal lunatics. There were no fresh admissions during the year. Two patients were discharged cured, 1 was made over to his friends in an improved state, and 2 died, thus leaving 27 still under treatment at the close of the year. The health of the lunatics was exceptionally good, and, considering the general unhealthiness of the year, indicates, the Sanitary Commissioner observes, "careful management and attention to the "general comfort and requirements of these poor unfortunates." Both the deaths which occurred in the asylum were due to causes quite unconnected with locality, residence, or treatment, being the result of cancer. Acting on the suggestion of the Government of India, the Amraoti asylum has been closed, and the patients have been transferred to the asylum at Nagpur.

Assam.

Several sanitary improvements were effected during 1883 in the Tezpur lunatic asylum in Assam, the most important being the erection of two new barracks, with a view to obviate overcrowding. The year began with 61 patients under treatment, and before its close 32 others had been admitted, making a total of 93. Of these, 1 escaped, 9 were discharged cured, 2 were made over to friends, and 14 died, leaving 67 inmates at the end of the year. The medical history of the asylum for the year is an unfavourable one. An epidemic of cholera appeared in June and lasted three weeks, during which there were 20 cases of the disease and 9 deaths. This weighted the mortality very considerably, and gave rise to the heavy death-rate of 219·5 per 1,000 of average strength against 53·0 in 1882 and a five years' average of 91 per 1,000. Of the causes to which insanity was attributed in 18 ascertained cases, no less than 8 were attributed to ganja, while opium was credited with one patient only.

British Burma.

At the Rangoon lunatic asylum, 245 patients were under treatment during 1883, of whom 56 were fresh admissions. By the close of the year 43 had been discharged (19 as cured), and 12 had died, leaving 190 in the asylum. Of the 56 fresh cases the insanity of 12 was attributed to physical and of 16 to moral causes; while in 28 cases, or one half, no cause was assignable. The patients are reported to have enjoyed excellent health throughout the year, there having been no sickness of importance except what was presented by those who eventually died. The proportion of deaths to daily average strength was 63·5 per 1,000, a lower rate than in any year since 1877. More than 80 per cent. of the inmates were employed, chiefly in some kind of out-door work.

Medical Schools.

Bengal.

At the Calcutta Medical College the session of 1883–84 began with 126 students; 39 students of previous years rejoined the class, and there were 32 new admissions, making a total of 197 students against 228 in the previous year. At the end of the session four senior scholars and four paying students passed their final M.B. or L.M.S. examination; 15 hospital apprentices passed, and left for regimental duties, while 57 students ceased to attend. Thus, at the close of the session, the total strength of the college was 117 against 126. For

the first M.B. and L.M.S. examinations, 42 candidates went up, and 21 passed against 12 in 1882–83, eight being placed in the first division; 10 candidates out of 28 passed the final examination for the license in medicine and surgery against 11; and 9 candidates obtained the degree of bachelor of medicine against 7 in the previous year. Women were for the first time admitted to the class of the Medical College, and special women's scholarships of the value of Rs. 20 a month, tenable for five years in the college, were created, and will be awarded for the next 10 years, without restriction of numbers, to all female candidates who join the Medical College after passing the First Arts Examination.

Favourable results were also obtained at the four vernacular Medical Schools. The number of students at the Campbell Medical School rose from 170 to 190, and out of 47 candidates 37 passed the final examination for a diploma against 20 in the previous year.

At the Dacca Medical School there were 131 students, being an increase of 12 on the number of the previous year, and 33 candidates out of 40 passed the final examination against 16. The Temple Medical School at Bankipore had 192 students, of whom 11 were transfers from the abolished Medical School at Nagpur; out of 34 candidates 28, including the 11 from Nagpur, passed the final examination against 26 of the previous session. The number of students at the Cuttack Medical School was 35, or one less than in the previous year; 9 candidates appeared at the final examination, and all passed, against 12 in the previous year.

Madras.

The working of the Madras Medical College in 1883 again showed satisfactory results. The number of students, excluding the junior department, which was abolished, rose from 153 to 197. Of these 113, including three females, were in the senior department, of whom 19 presented themselves for the University examinations, when only two failed. The number of candidates is considered small when compared with the strength of the various classes of this department, and appears to be due mainly to the desire on the part of many of the students to obtain British qualifications, but the results of the examination were looked upon as very creditable to the class. In the second department there were 84 students, including 7 females. Twelve candidates, including one female, appeared for their final examination, and all passed. Of second year students, 26 went up for the primary examination, and all passed and acquitted themselves creditably, 4 getting places in the first class. Three females also appeared for examination and passed with credit. The Director of Public Instruction agreed with the Principal of the College that "the result of these examinations, characterised as it "is by absence of failure, must be very gratifying alike to teachers and to pupils." During the year, several students proceeded to Europe to continue their studies there.

It is gratifying to learn that His Highness the Maharajah of Travancore has generously given Rs. 6,000 for founding a scholarship tenable by women, and to be called the "Bharati "Lekshmi Scholarship." His Highness also gives a gold medal yearly to the best female student in midwifery.

Bombay.

In the Grant Medical College a class for female students has been opened in consequence of the demand which has arisen for female practitioners. At the commencement of the session of 1883–84 there were 12 members of this class, one of whom was an undergraduate of the University. "It is satisfactory to see," the Principal of the College observes, "that "at the inauguration of this new class some very promising candidates have presented "themselves, and I would here state that the conduct of all has been exemplary."

With regard to male students, the number on the rolls during the session was 338 or 5 less than in the previous year. Thirty-eight undergraduates competed for the L.M.S. degree of the University, and 28 passed,—5 in the first and 23 in the second class. At the first L.M.S. examination there were 93 candidates, 43 of whom were successful, 7 passing in the first and 36 in the second division. Three assistant surgeons presented themselves for examination for the higher grade, and all were found qualified for promotion. From the hospital apprentice class 13 fully-instructed apprentices passed out for duty.

The medical schools at Poona, Ahmedabad, and Hyderabad, were progressing favourably, and like the Grant College have been thrown open to women. There was a decrease in the number of students at Poona and Ahmedabad as compared with the previous year, but in the Hyderabad School the number of pupils rose from 30 to 38. The results of the examinations were on the whole satisfactory. Fifteen senior students from Ahmedabad and 16 from Poona passed their final examinations. The Hyderabad School having been open for only two years was unable to send up any men for final examination.

VII.—SANITATION.

Bengal.

On the whole, the progress made in 1883 in improving the sanitary condition of the town of Calcutta does not compare favourably with the previous year. Amongst the improvements effected was an increase in the filtered water-supply from a daily average of 7,868,062 to 7,975,960 gallons, and during the hot weather months, March to June, to a daily average of nearly 8½ million gallons. It has long been recognised that the supply was incommensurate with the essential requirements of the town, and it is satisfactory to learn that Calcutta was within measurable distance of an adequate provision of this first necessity; though, unfortunately, there appeared to be little probability of the new extensions being in working order by the hot season of 1885. There was also an increase in the daily average supply of unfiltered water from 1,988,175 gallons to 2,035,808. The drainage system of the town was nearing completion, though the amount of work executed did not come up to that of previous years. Only 46,672 feet of sewers were constructed, and of these 18,796 feet were converted into paths varying from 3 to 10 feet, and 3,713 feet were converted into roads 15 to 20 feet wide. During the year much attention was given by the Commissioners to the reclamation of bustees. Eighteen projects for the structural improvement of bustees were under consideration, but only one was completed; in four the work was well advanced, and the remaining 13 had not advanced beyond the preliminary stage. Out of the grant of 15,000*l.* made to meet the cost of sanitary and structural improvements in the bustees, little more than a third was expended.

For some time past the Calcutta sanitary question has been a subject of controversy between the Government of Bengal and the Municipal Commissioners; and in 1884 the Lieutenant-Governor of Bengal appointed a Commission to investigate the matter. The Commission, while fully admitting that much had been done of late years to improve the sanitary condition of the city, pointed out the great need for more active measures; at the same time they made several important recommendations with regard to future work. Both the Governor-General of India and the Lieutenant-Governor of Bengal concur in the views of the Commission, and trust that the Municipality will spare neither trouble nor expense to complete the sanitary reforms so much needed. A Memorandum on this subject by the Army Sanitary Commission will be found in the Appendix, p. 233.

At the port of Calcutta cleanliness was fairly maintained throughout the year at all points of the river bank on the Calcutta side; the khal, however, which passes through the premises of the ex-king of Oudh, discharged into the river the drainage and, at times, much filth, which it brings down from the interior; sewage was again being discharged into the river from the flushing inlet at the Port Commissioners' jetties. The attention of the authorities was called to these matters, and thus led to their rectification. The Calcutta foreshore was being further improved by the erection of additional public latrines. The condition of the Howrah foreshore was reported to be satisfactory. An embankment was in course of construction on this side of the river, which, it is believed, will assist in improving the conservancy of the bank. Attention was called to the want of latrine accommodation for those who will use this embankment.

Of a total income of 332,876*l.* the municipalities of Bengal expended 114,793*l.* or nearly 34½ per cent. on sanitary works against 31 per cent. in 1882, besides 60,616*l.* on the construction, maintenance, and repair of roads. The expenditure under water-supply amounted to 16,045*l.* against 3,109*l.* in the previous year; but of this amount 11,052*l.* were spent on the water-works of Burdwan, in which considerable progress was made. Improvements were also made in the water-supply for the towns of Berhampore, Dacca, English Bazar, and Kurseong. The question of the extension of the Calcutta water-supply system to the suburbs engaged the careful attention of the Government during the year, and it was expected that material progress with the works would soon be made. A scheme for providing a supply of filtered water for all the riparian municipalities on the right bank of the Hooghly, between Serampore and Howrah, was also proposed; but the difficulties in the way of carrying it into effect have been found more considerable than was anticipated. The obstacles, however, were not considered insuperable, and it was hoped that before long some feasible solution would be discovered. Meanwhile, the proposal was under the consideration of Government.

In several towns drainage schemes were inaugurated, and in most cases taken in hand. Progress was made with the Cuttack drainage scheme which was commenced in 1879, and the town is believed to be now fairly well drained. Further improvements were effected in the fever-stricken district of Nuddea, and in the Sonthal Pergunnahs a survey of the great swamp to the south of Rajmehal, which is a source of much disease, was made with a view to improve its drainage.

Among the miscellaneous sanitary operations of the year was the extension of sanitary clauses of several Bengal Acts to a number of towns and villages; and new Acts were passed

for the sanitation of Indian merchant shipping, the regulation of Native passenger ships, and for revising the law relating to municipalities in Bengal. During the year a number of villages was inspected by the officers of the vaccination staff, and their reports revealed a sad neglect of sanitation by the people. One officer states that in each village, hat, and bazar which he visited he delivered lengthy and earnest addresses on sanitary matters, pointed out defects, and made suitable and practical remedial suggestions. "To remedy "defects," he says, "such as I have noticed, sanitary legislation of some sort to meet the "requirements of rural dwellings is called for, if the physical welfare of the people is to be "espoused. My observations teach me that the people, rich and poor, educated and "uneducated, alike, cannot, or will not, actively bestir themselves in bringing about sanitary "reforms." Speaking of a village in Dacca, which was visited by a severe outbreak of cholera, he says: "The wonder to my mind is that the health of the people is as good as it is, and "that they look as well as they do, seeing their almost indescribably filthy surroundings "and unclean habits." In discussing this subject the Army Sanitary Commission remark: "The obvious consequence of this state of matters is that the Government should "step in and deal with these sanitary problems. Something has been done for the towns, "and, as we have seen, some improvements are being carried out there, but as we have often "urged, the town populations are a mere fraction of the whole population of Bengal, "and it is hence in the villages that the causes of epidemics have to be encountered "and overcome."

Madras.

Good progress was made with the drainage scheme for Black Town during 1883. The pump and engine house at Rayapuram, the outfall channel and masonry weir, and one of the main sewers of the new drainage system were practically completed. In connection with the general scheme 11¼ miles of surface drains of various sizes were constructed; 314 new house drains were constructed by the owners themselves, and 21 by the municipality. The total amount expended on drainage during the year was 16,435*l.*, which added to 7,892*l.* spent in 1882 gives a total expenditure of 24,327*l.* out of an available sum of 40,000*l.* raised by loan for the purpose.

Further progress was made in the useful work of diverting drains from the Cooum and the canal. The diversion from the river of the contents of the large sewer near Government House was nearing completion at the end of the year, and the engines and pumps were in course of erection.

The extension of the water-supply throughout the town which was commenced in the previous year was completed at a total cost of about 26,000*l.* Pipes of various sizes extending over 28 miles were fixed, besides 170 valves, 463 hydrants, 178 fountains, and 27 silt traps which were considerably over and above the number contemplated in the original extension scheme. The water-supply from the Red Hills was maintained throughout the year, excepting for two days in September in five divisions (4th to 8th), when the supply was shut off to enable a 14" scour-pipe to be fixed at the junction of Purasavakum High Road and Brick Kiln Road. Proposals were made to secure the conservancy of the shores of the Red Hills Lake, and powers were inserted for this purpose in the new Municipal Act.

In the municipalities of Madras Presidency, exclusive of the City, the sanitary allotments for 1883–84 aggregated 57,000*l.* or 33·2 per cent. of income against 49,000*l.* or 31 per cent. in the previous year. Of this sum, however, only 69 per cent. was expended during the nine months ending December 1883. No sanitary work of any magnitude was carried out during the year; the operations consisted mainly in repairing and cleansing of tanks and wells, latrines, drains, &c.; in the construction of latrines, drains, and dust-bins; in the sinking of wells, and in some other minor works. Similar work was executed in the local funds circles, where the amount set apart for sanitary purposes was nearly 40,000*l.* or 28·8 per cent. of income. Compared with the previous year this shows a falling off of 3,700*l.*, but with very few exceptions the allotments were considered generally sufficient. Of the sanctioned allotment 45 per cent. remained unexpended at the close of December. The attention of the authorities has been called to the custom of leaving so large a proportion to be expended at the end of the year, "the result being," the Government observe, "that large "sums not unusually lapse, or that the works are hurried through, or badly done." It is noticed that in the previous year (1882–83), 9·7 per cent. of the whole allotment of the municipalities remained unutilised, and 20 per cent. of that of the local funds. "It is to "be hoped," the Sanitary Commissioner remarks, "that recent orders of Government and of "the Board of Revenue on the subject will in future have the desired effect towards the "complete utilisation of funds placed at the disposal of the local authorities for sanitation, "and that as skilled agency has now been provided by the appointment of district "medical and sanitary officers for indicating and devising measures by which the funds

" of the local boards can be most advantageously expended, conservancy and improvement " of village sites and water-supply—the greatest sanitary needs of a locality—will receive " due attention, and the expenditure on their account will be strictly watched."

Bombay.

Considerable progress was made during 1883 in measures for the improvement of the Bombay water-supply. The construction of the new reservoirs on Bhandarwada and Malabar hills was completed, and the catch-water channels at Vehar and Tulsi, for increasing the gathering-ground, were being energetically pushed on. The laying of the new water main to Vehar was expected to occupy two seasons, but it was hoped that the portion that was expected to be ready by the end of the first season (which would be connected with the existing main at Coorla) would confer an appreciable benefit in the hot season. Owing to the increased height of the dams of the Tulsi lake, the draw-off was at a higher level than in previous years. Wastage of water from leakage, to the extent of nearly 400,000 gallons a day, was discovered and rectified, and with a view to its prevention, the Deacon metre system, which has been found to answer well in provincial cities in England, was to be introduced as soon as possible. The drainage of the city was receiving careful attention. Much was done to relieve the low-lying parts of the city from floods by the construction of intercepting drains; but the Municipal Commissioner points out that an intolerable nuisance is caused by the carriage in them of sewage, which must continue until all sinks, gullies, and cesspools are connected with new sewers. "Whether " the whole of the sewage," the Health Officer of the City remarks, "will ultimately be " carried by the sewers, or whether the more highly scientific and sanitary mode of conveying " by them only the sullage and subsoil water, and of returning the night-soil to the land " to be adopted, it is a matter for sincere congratulation that—it is to be hoped—at no very " distant date the larger number of the 1,800 cesspools which are to be found scattered " over Bombay will be done away with, and the disease-producing subsoil water, in a " measure, removed. When this has been accomplished, and a sufficient supply of whole- " some drinking-water provided, two of the chief causes of disease in this city will have " been swept away." Good work was done during the year in road-making. Several new ones were made; but the greatest improvement in this direction was the extension of Charni Road to Grant Road, by which a new thoroughfare which was much needed has been created.

The Sanitary Commissioner of Bombay, Deputy Surgeon-General Hewlett, testifies to the many improvements in the city of Bombay which have taken place during the last 10 years. He says: "Perhaps no greater has been effected than the raising of the ground level in " Khetvadi by filling it in. On all sides I see places which I remember to have been sources " of disease gradually being improved, but the town is still an Augean stable, and requires " an immense deal to be done to it before it can be considered as at all approaching a " satisfactory condition; one of the greatest wants from a sanitary point of view, after an " additional water-supply and the completion of the sewage scheme is, in my opinion, a " Building Act. This want, ever since the municipality has been established, now 19 years " ago, has been repeatedly brought to notice, but the question has always been shelved, as " it would be unpopular among the property-owning classes. Still, I think, that in the " interests of public health it should be urged again and again." This matter was receiving the attention of the Government. The Governor in Council was of opinion that such further provisions as might be considered necessary, could most appropriately be embodied in the amended Municipal Act, and with this view the Sanitary Commissioner has been directed to state in detail the amendments and additions which he considered necessary.

No special sanitary work of any magnitude was accomplished in the other municipalities of the Bombay Presidency during the year, though much was done in improving the water-supply and drainage of towns, and minor matters. Out of a total income of about 271,000*l.*, nearly 115,000*l.* were expended on conservancy; while in the local fund circles about 27,000*l.* were spent in the construction of sanitary works. The Kas waterworks for supplying the town of Satara were completed, as were also the new waterworks at Chiplun. The scheme for bringing the Mahi water to Karachi was drawing towards completion; pipes were being laid on to all public places, gardens, and private houses. There was little expenditure on drainage works during the year. At Ahmednagar branch drains were constructed and connected with the two existing drains. At Nasik five new drains were constructed and connected with the existing drains. At Sukkur the new drainage scheme for new Sukkur and Ghariliabad was sanctioned, and a commencement made with the works. In the Surat Municipality measures were being devised for a thorough drainage of the city by means of underground drains; but these, it appears, cannot be carried out until a sufficient supply of water for flushing is obtained.

During his tour of inspection the Sanitary Commissioner (Deputy Surgeon-General Hewlett) was surprised at the energy shown by some of the municipalities in matters of sanitary

reform. During a visit to Ahmedabad he had the opportunity of perusing a memorandum written by the Chairman of that Municipality for the benefit of his colleagues, "and the "thorough knowledge of the subject displayed in it," he says, "as well as the extremely "practical and sound advice given in it struck me so forcibly that I submitted it to Govern- "ment, with a request that I might be permitted to have it printed as an appendix to my "annual report, as in my opinion it is a most remarkable document to have been written by "a native gentleman, and it will show the Secretary of State the great good that is being "effected in this country by the publication of the memoranda of the Army Sanitary "Commission. It will also, I hope, give a stimulus to Commissioners in other municipalities "to follow so excellent an example." Mr. Hewlett concludes his report with the remark "that although the year has been one in which there has been an unusually heavy death-rate, "yet the prospects of real sanitary reform being introduced are most encouraging, as Govern- "ment has, in many important points, indicated its determination to initiate measures which "cannot fail to produce a lasting improvement on the public health of this Presidency."

Punjab.

The income of the municipalities in the Punjab during 1883 amounted to 410,047*l.*, of which 121,977*l.* were spent on sanitary works. The expenditure on this head is reported to be steadily increasing in many towns, which would seem to indicate that municipal committees are taking more interest in matters of this kind than formerly. The Lieutenant-Governor hopes that district officers will, with the assistance of district boards, effect similar results in the matter of village sanitation. Of the sanitary works completed or undertaken during the year, the following were among the most important. In Lahore the new reservoir for storing drinking water was approaching completion. The water supplied from the system was said to be excellent, it was universally used, and is reported to have had a beneficial effect on the health of the people. Considerable improvements were effected in the drainage system of Lahore city, and a project was in contemplation for draining the civil station. In Amritsar the plans for the scheme for a water-supply were well advanced; good progress was made with the extra-mural drainage project for the city; but very little was done towards the intra-mural scheme; an income of about 2,500*l.* was derived from the sale of manure, and the sanitation of the town had much improved. At Simla progress was made with the Sanjauli reservoir in connexion with the waterworks, and it has since been completed; and a project was under consideration for replacing by oval-shaped cast-iron drains the wooden V-shaped drains used for carrying off the drainage of the bazaar into Combermere ravine. Plans and levels for the drainage of Sialkot city have also been prepared. A covered drinking-water tank was completed at Deoband in Derajat division, and similar tanks have been made on the Murree and Abbottabad road in Rawal Pindi. At Georgegarh in Rohtak, a large masonry tank has been built to meet the deficient supply of water. The Peshawar Municipality brought to completion the large project known as the city canal, which has been for some time under construction. The work, which has cost a considerable sum of money, consists of a main channel of flowing water from the Bara river, pure enough for all ordinary purposes, with a masonry channel at lower level on either side, by which the drainage of the city is carried off.

North-Western Provinces and Oudh.

In the North-Western Provinces and Oudh no special sanitary works of importance were undertaken during the year, but many improvements were effected in roads, drainage, sources of water-supply, conservancy, &c. "Wherever the means of improvement are available," the Sanitary Commissioner states in his Report for 1883, "there some proportion of the available "income is expended for the improvement of the habited site or its precincts. These improve- "ments of every kind and character have been reported to me for information." With reference to this statement the Army Sanitary Commission remark: "A comparison of the "death-rates for five years preceding 1883, would apparently lead us to the conclusion that "life was being saved under the existing sanitary administration and progress. Thus, the "town death-rate in 1883 from all causes was 35·32 per 1,000, while the previous five years' "ratio was 40·88 per 1,000, showing a reduction of 4½ per 1,000."

Central Provinces.

The only sanitary works of any importance carried out in the Central Provinces during 1883 were the completion of the waterworks at Jubbulpore and Hinganghat. In most of the districts good work was done in providing better water by new wells, in cleansing and repairing tanks, and in constructing roadside drains, &c. In reviewing the Sanitary Commissioner's Report for 1881 the Army Sanitary Commission called attention to several disease causes in the villages of these provinces as revealed by the reports of inspection officers, with the remark that "a mere statement of them ought to carry the remedies with it." To this the local authorities have replied that the difficulties to be encountered are very great. "In "fact," they say, "there is no more difficult problem than to get the villagers to recognise "the insanitary and unwholesome condition of their surroundings, to revolutionize their daily

" habits and practices, and to supply the very considerable sums of money which would be " needed to remove even any one of the causes to which disease is attributable." With reference to this statement the Government of India say: " There is no doubt much truth in " these remarks, but it is equally true that if district officers really interest themselves in " the matter, a great deal can be done by their influence and judicious guidance to improve " the surface drainage of villages, to set apart and preserve in good order tanks or wells for " providing pure water to the villages, to keep clean the compounds and surroundings of " houses, and to provide accommodation for keeping cattle as well as for latrine purposes at " a distance from human habitations. It is of the highest importance that the improvement " of the conditions under which the people live should be regarded as most intimately connected " with their happiness and prosperity, and that it should not be set aside as a thing which is " practically impossible." To this " wise judgment " the Army Sanitary Commission have nothing to add. " It involves," they say, " no outlay for great sanitary works. The people " themselves could do nearly the whole of it. Cleansing and keeping clean, with a little " spade labour now and then to drain the surface, and very ordinary care in protecting water " sources would soon tell on the sanitary state of villages, if the local officers would include " these matters as amongst those on which their influence might be brought to bear."

Berar.

In Berar the works for supplying the town of Amraoti with water by means of pipes from the Kalapani tank, at an estimated cost of 30,000*l.*, was in progress, and have since been completed. The Wadali tank, intended for both cattle and drinking purposes at the station of Amraoti, was completed, and the Hergowan tank for the use of cattle was in course of construction. In Ellichpur district tanks were being constructed for providing water for both cattle and drinking purposes. Tanks and wells were also built in the Akola and Buldana districts. In the six municipalities of the province 16,943*l.* were allotted for sanitary purposes, of which 15,688*l.* were spent; but of this amount only 2,393*l.* were expended on village sanitation. The results of the inspections of villages and towns by the Sanitary Commissioner revealed a state of things sadly calling for improvement. So long as such filthy habits and customs exist, the Army Sanitary Commission observe, " the main disease " causes will continue to act just as they do at present. That the municipal towns require " thorough improvement is shown by the disease statistics, and a comparison with the jail " death-rates for corresponding years points clearly to the direction in which improvement " should be carried out." The Resident has again called the attention of all district officers " to the necessity of carrying out the rules laid down in the village Sanitary Code, and of " preventing as far as possible the accumulation of manure and filth inside the boundaries " instead of at suitable places on the outskirts of each village."

Assam.

On sanitary improvements in Assam a sum of 8,348*l.* was expended in 1883, which is a considerable increase on 5,657*l.*, the amount spent in the previous year. The new water supply for Shillong was completed at a cost of 1,500*l.*, and has provided the station, it is stated, with as pure and abundant a water service as any station in India. The native population has received it with great favour, and new pipes were still being laid down to supply private taps to the houses of fresh applicants. The scheme for supplying Gauhati with pure water was also in progress. The drainage works in Goalpara after long delay have been completed, " and the local opinion strongly holds that they have caused a great " improvement in the sanitary condition of this once water-logged town." In no other municipality was any special work carried out, but nearly all of the municipalities spent larger sums than in the previous year in street-sweeping, cleaning of drains, and construction of roads and culverts. " The first and most pressing want of all towns in Assam," the Chief Commissioner notices, " is a pure supply of water: it ranks before drainage and before " latrines." Instructions were to be issued to all district engineers to draw out plans for providing water to all the towns on the same system as has been devised for Gauhati.

British Burma.

No sanitary works of any great importance were undertaken in British Burma during 1883, except a comprehensive scheme of water-supply and drainage for the town of Prome, the works connected with which were making rapid progress. Much attention has been devoted to the sanitary improvement of Prome of late years, and now that drainage and water-supply have been provided, steps were being taken to improve the conservancy system. In Rangoon the waterworks were all but completed, and water was laid on to all the principal streets. The drainage of the town was also receiving attention, and some preliminary steps towards its execution were taken. In almost all the principal towns many minor improvements were effected in cleansing and repairing wells, constructing public latrines and drains, filling cess-pits, &c., while everywhere great attention was given to conservancy arrangements. On such improvements a sum of 19,996*l.* was expended by the 15 towns of the province.

No progress, however, appears to have been made in improving the sanitary condition of villages. "In this direction," the Chief Commissioner says in his Resolution on the Sanitary Commissioner's Report, "rapid progress is hardly to be expected. The elements "of sanitation are now taught in all Government schools, and it may be hoped that the "people will gradually learn to effect for themselves many sanitary improvements which "Government officers are powerless to effect for them."

Military.

Bengal. The total expenditure on military works in the Bengal Command during 1883–84 was 673,532*l.* against 531,306*l.* in the previous year. The works included new barracks at several stations, new hospitals, and buildings for the general requirements of the Commissariat department. Military roads were under construction, the most important of which was the Bolan high-level road from the terminus of the railway at the mouth of the pass along the Bolan valley and across the great dasht or plain to Quetta, the entire length being 86 miles. Amongst general cantonment works were the completion of the Peshawar water-supply scheme, the extension of the Umballa water-supply, the provision of water to Pishin, and the commencement of the supply of water to Chakrata. Drainage works at Naini Tal have been carried out, and further progress made with the drainage of Quetta, and also with its cantonment roads.

Madras. The Surgeon-General of Her Majesty's Forces in Madras Presidency reports that during 1883 the sanitation of all buildings connected with the troops as well as their surroundings was carefully attended to, and special precautions taken as epidemic disease was prevalent among the civil population. The supply of water has generally been sufficient and the quality good, and every attention has been paid to the protection of the sources of supply. The improvement of the water-supply at Bangalore was receiving the earnest attention of Government; while efforts were being made by the municipality to improve the sanitation of the Ulsoor bazaar, the proximity of which to the infantry barracks at Bangalore caused some anxiety during the prevalence of cholera. Generally speaking, the drainage of the stations was satisfactory. The Madras Municipality were doing their best to put a stop to the long-standing nuisance in Fort St. George caused by the discharge of fœtid sewage from the main drain into the sea just outside the fortifications. At the station of Secunderabad there appears to be a want of proper drainage from the town. At present, it is reported, the whole of the sewage runs by the back of the staff lines into the Husain Saugor tank which was very detrimental to the health of the neighbourhood. A scheme, however, for improving the drainage of the town was under the consideration of the Resident.

Bombay. The expenditure on military sanitary works in the Bombay Presidency during 1883 was 17,473*l.* against 11,904*l.* in the previous year. Of this sum about 9,580*l.* were expended on Native lines for Jacobabad. At Ahmedabad, 3,458*l.* were spent on sanitary improvements, all but 32*l.* being devoted to the construction of a hospital for British troops. At Nasirabad 2,134*l.* were expended, nearly a quarter of the amount on the construction of new open drains; while at 19 other stations various minor works were undertaken, including the preservation and watering of trees planted in connexion with sanitary improvements to Ghorpuri barracks at Poona.

W. T. Ronson.

India Office,
November 1885.

ABSTRACT

OF

SANITARY AND OTHER REPORTS

FOR

1883.

ABSTRACT OF REPORT OF THE SANITARY COMMISSIONER WITH THE GOVERNMENT OF INDIA FOR 1883.

(DR. J. M. CUNINGHAM.)

European Troops.

During 1882 the health statistics of the army of India are as a whole most favourable. During 1883 they were more favourable than they had been in 1882. From the following table it will be observed that the admission, daily sick, and death-rates for 1883 are lower than those of any of the previous years there given, and that all, except the daily average sick-rate, are lower than the average of the ten-year period 1870–79 :— Sickness and mortality in 1883.

Year.	Strength.	Ratio per 1,000 of Strength.				
		Admissions.	Daily sick.	Deaths.	Invaliding.	Total loss.
1870–79	577,416	1,475	60	19·34	43	62
1878	56,475	1,651	68	21·46	45	66
1879*	49,582	1,927	76	24·28	49†	73†
1880*	51,796	1,789	74	24·85	26†	51†
1881†	58,728	1,605	70	16·86	38	55
1882	57,269	1,445	65	12·07	33‡	45
1883	55,525	1,336	63	10·88	33	44

* Excluding troops serving in Afghanistan. † Including troops in Afghanistan.
‡ Calculated on the strength obtained from Annual Returns.

The admission-rate, 1,336 per 1,000, is indeed the third lowest on record since 1870, when the statistics for the army of India were first compiled as a whole; in 1873 the admission-rate equalled 1,328, and in 1877 it was at the minimum of 1,257. Notwithstanding the low admission-rate of the year, the daily average sick-rate (63) was higher than the ten-year average of 1870–79, and higher than that of every year from 1870 to 1877 inclusive. The death-rate for the year 1883 was 10·88, the lowest on record since 1870, when it equalled 21·11. This result was most gratifying, falling short, as it does, of the average death-rate for the period 1870–79 by 8·46 per 1,000. The loss to the army, due to invaliding, was 33 per 1,000, identical with that of the preceding year, but 10 per 1,000 less than the average loss on this account during the period 1870–79. The total loss to the army from death and invaliding was 44 per 1,000, or less than the average annual loss of 1870–79 by 18 per 1,000.

The vital statistics of the army of the Bengal Presidency, taken by themselves, are very satisfactory. The average strength was 34,079, against 35,164 in 1882. The admission-rate was 1,463, a smaller ratio than that of any single year since 1878, and considerably smaller than the average ratios of the ten-year periods 1860–69 (1,755) and 1870–79 (1,522). Of the past 23 years since 1860 better results were recorded in 7, the most favourable having been 1,251 in 1877. The daily average sick ratio is still high, namely 66 per 1,000. It exceeds the average of the period 1870–79 (61) by 5 per 1,000, but is less than that of 1860–69 (67) by one only. The most satisfactory feature in the statistics of this portion of the army of India is the greatly diminished mortality. This equalled 11·21, and is the lowest ratio on record. The nearest approach to it was in 1877, when it equalled 11·64. The death-rate of 1883 was thus 9·79 per 1,000 less than the average death-rate for 1870–79 (21·00), and 18·77 per 1,000 less than the average of 1860–69 (29·98). The mortality from cholera was also exceptionally low; it was 0·94 per 1,000. The average death-rate from this disease during the last two decennial periods was 4·18 (1870–79) and 9·24 (1860–69). The cholera mortality of the year under review, however, is not the lowest on record, for the rate in 1870 was only 0·68, and in 1871, 0·71, in 1873, 0·90, in 1874, 0·21, and in 1877, 0·44. The loss by invaliding was 31, or 10 per 1,000 less than the average

loss during 1870–79. The total loss to the Bengal Army from death and invaliding was 42 against 48 in 1882, and 62 the average total loss during 1870–79.

In the Madras army also the results are, on the whole, very favourable. Out of an average strength of 10,498, which was somewhat less than in 1882, the admission-rate was 1,013, the lowest on record since 1870; the next lowest (1,053) having been in the preceding year 1882. The daily average sick ratio (59), however, did not show a corresponding decrease; it was slightly higher than that of 1882 (57), and practically the same as the average for 1870–79 (60). The death-rate was 10·19; a result almost identical with that of 1880 (10·18), the lowest on record. Deducting the mortality due to cholera, which was 0·95, the ratio was 9·24, or the same as that of 1881. The loss by invaliding was higher than it has been of late years, and equalled 33 per 1,000. The average of 1870–79 was 49. The total loss to the army from death and invaliding was 43, or 9 per 1,000 greater than it had been in 1882; a result which is accounted for exactly by the increase of invaliding.

The average strength of the Bombay army, (10,948) was a little less than it had been in 1882. The admission-rate was 1,249, the lowest on record. The daily average sick (57), however, did not fall in a corresponding degree, and remained the same as the average for the period 1870–79. The total mortality from all causes (10·50) was in excess by a fraction of that of the preceding year (10·37). The excess was due to cholera mortality; for deducting the deaths due to this disease the mortality from all other causes (9·68) was less in 1883 than it had been in 1882 (9·74), and is the lowest on record.

The force in Southern Afghanistan is included in the Bombay statistics referred to in the preceding paragraph, but it is desirable also to show the results among these troops separately. Out of an average of 1,034, which was slightly in excess of that of the preceding year (929), the admission-rate was considerably below what it had been during the two previous years; but both the daily sick and death-rates were higher. The daily sick-rate was 78, which is considerably above the average rate for the army of India during the ten-year period 1870–79, when it stood at 60. The death-rate from all causes was 15·47, as compared with 9·69 in 1882, 51·55 in 1881, 49·00 in 1880, and 59·48 in 1879. There was no mortality from cholera, as indeed there had been none in former years excepting in 1879, when a proportion of 32·69 was due to this cause. There were in all 16 deaths against 9 in 1882. Of the 16, five were due to enteric fever and four to respiratory diseases.

Malarial fevers as usual gave rise to the largest number of admissions in the Bengal Presidency, or an equivalent of 486 per 1,000. This ratio, however, is a great improvement upon those of the majority of previous years. The average admission-rate under this head for the ten-year period 1860–69 was 633·0 per 1,000, whilst for the succeeding ten-year period 1870–79 it was 607·3. The ratio for 1883 shows, therefore, a considerable reduction over the averages of both periods, and compares even more favourably with the ratio of 1882, which was 660 per 1,000. A similar, though not so marked, diminution occurred in the admissions from fevers in the Madras and Bombay Presidencies, both as compared with the ratios of the preceding year and with the average results of the ten-year period 1870–79. In the Madras Presidency the ratio was 128 per 1,000 against 171 in 1882, and in the Bombay Presidency, 436 against 558. The average for the ten-year period 1870–79 in Madras was 266, whilst in Bombay it was 660.

Admissions from Chief Diseases per 1,000 of strength.

Bengal.		Madras.		Bombay.	
1. Malarial fevers	486	1. Venereal diseases	289	1. Malarial fevers	436
2. Venereal diseases	281	2. Malarial fevers	128	2. Venereal diseases	218
3. Wounds and accidents	117	3. Wounds and accidents	103	3. Wounds and accidents	108
4. Abscess and ulcer	89	4. Abscess and ulcer	70	4. Respiratory diseases	73
5. Respiratory diseases	88	5. Dysentery	49	5. Abscess and ulcer	64
6. Rheumatism	56	6. Diarrhœa	45	6. Rheumatism	44
7. Diarrhœa	49	7. Respiratory diseases	41	7. Diarrhœa	39
8. Hepatitis	27	8. Hepatitis	41	8. Hepatitis	23
9. Dysentery	23	9. Rheumatism	34	9. Dysentery	18
TOTAL OF THE NINE	1,216		800		1,023
TOTAL FROM ALL CAUSES	1,463		1,013		1,249

The admission-rate from venereal diseases was highest in the Madras Army (289), and lowest in the Bombay Army (218). In Bengal it was higher (281) than it had been in

1882 (271); in Madras it was practically the same (289 against 288 in 1882), and in Bombay it was somewhat less (218 against 224). In all three Presidencies the admission-rates were in excess of the average rates for the ten-year period 1870–79, the excess being 72 per 1,000 in the case of Bengal, 91 in Madras, and 27 in Bombay. Respiratory diseases, as usual, gave rise to the highest admission-rate in Bengal, 88 per 1,000. It was 41 in Madras and 73 in Bombay. These ratios for Bengal and Bombay are higher than the average ratios for 1870–79, which were 84 and 64, respectively; that for Madras for the same ten-year period having been only 57. Diarrhœa was more prevalent in the Bengal and Madras Presidencies than in the Bombay Presidency. In all Presidencies the ratios under this head are less than the averages for 1870–79. Dysentery and hepatitis were, as usual, much more prevalent in Madras than in Bengal and Bombay. Scurvy does not appear in the statistics among the diseases which caused admissions into hospital; but the Surgeon-General, Her Majesty's Forces, Bengal Presidency, in remarking upon the health of the men during 1883, writes that "scurvy sometimes in a pronounced form, but most commonly in a "mild one, has been prevalent amongst men of many corps and at different stations; those "serving at hill stations have proportionately suffered most in this respect, and no doubt the "scorbutic taint in particular men has commonly, if not always, been a sequel in malarial "fever illness."

Enteric fever again heads the list of the chief causes of death in all three Presidencies. The highest ratio under this head was recorded in the Madras Presidency (2·86), and the lowest in Bombay (1·55), the Bengal ratio being intermediate (2·52). During 1882 the number of deaths ascribed to this cause in Madras rose suddenly, and during 1883 the ratio has for the first time exceeded the ratios of the Bengal and Bombay Presidencies. It was almost exactly double the average rate of the ten-year period 1870–79. Further details regarding enteric fever will be found in a subsequent paragraph.

Deaths from the Chief Diseases and from All causes in the Three Presidencies per 1,000 of strength.

Deaths from	Bengal.					Madras.					Bombay.				
	1883.	1882.	1881.*	1880.*	1870-79.	1883.	1882.	1881.	1880.	1870-79.	1883.	1882.	1881.*	1880.	1870-79.
Enteric Fever	2·52	2·90	2·62	3·07	2·28	2·86	2·09	0·58	1·36	1·42	1·55	1·90	2·83	5·76	1·75
Apoplexy	1·32	0·94	1·75	3·14	1·58	0·38	0·82	0·96	0·78	1·42	1·10	0·63	1·21	3·03	1·56
Hepatitis	1·06	1·48	1·64	1·36	2·04	1·72	1·72	1·54	1·26	3·16	0·82	0·81	1·52	1·31	1·71
Cholera	0·94	1·28	3·23	4·84	4·18	0·95	0·82	1·73	0·10	1·68	0·82	0·63	0·30	—	1·53
Remittent and continued fevers	0·41	0·74	0·70	2·34	1·74†	0·28	0·27	0·19	0·29	0·62†	0·55	0·54	0·91	2·73	1·14†
Dysentery	0·35	0·77	1·00	2·72	1·37	0·28	0·36	1·15	0·56	2·32	0·55	0·18	1·82	4·14	0·99
Total of these Diseases	6·60	8·11	10·94	17·47	13·14	6·47	6·08	6·15	4·37	10·62	5·39	4·69	8·59	16·97	8·67
All Causes	11·21	13·17	17·05	27·73	21·00	10·19	10·25	10·97	10·18	17·69	10·50	10·37	13·44	30·90	15·27

* Excluding troops in Afghanistan and on the march. † Include deaths from intermittent fever.

Hepatitis as usual caused the largest proportion of deaths in the Madras Presidency (1·72 per 1,000). The death-rate for the year, however, was only about one-half the average death-rate of the period 1870–79. In the other two Presidencies also the mortality from this cause was less than the ten-year average. It was in Bengal 1·06 and in Bombay 0·82. The death-rates from cholera were remarkably low in every Presidency; as already shown, they were for Madras 0·95, Bengal 0·94, and Bombay 0·82. The ratio for Bengal is particularly low; the average mortality during 1870–79 having been 4·18. Apoplexy caused the largest number of deaths in Bengal (1·32 per 1,000). In Madras the death-rate from this disease was particularly low, 0·38 per 1,000 against 1·42 the average of 1870–79. In Bombay it was 1·10, a ratio higher than that of the preceding year, but less than the ten-year average. There has been a reduction of death-rate from dysentery in the Bengal and Madras Presidencies, both when compared with the ratios of the preceding year and with the ten-year averages; in the Bombay Presidency the death-rate from this disease (0·55) was higher than it was in 1882 (0·18), but still lower than the ten-year average (0·98). The mortality from remittent and continued fevers was greatest in the Bombay Presidency (0·55) and least in Madras (0·28); in Bengal it was 0·41. All these ratios are less than the ten-year averages; but the most striking reduction occurred in the Bengal Presidency.

Excluding convalescent depôts, where troops are located only for a portion of the year, the statistics of the army of the Bengal Presidency have been divided into six groups. Of these four show a higher admission-rate than the average for the Presidency as a whole, whilst one was nearly equal to it, namely, Bengal Proper, and one was considerably below it. The highest admission-rates occurred in the Punjab (1,601), and Meerut with Rohilcund groups (1,528), and the lowest in Bengal Proper (1,011).

Statement showing the Admission and Death-rates in the several groups of Stations of the Bengal Presidency during the ten-year periods 1860–69, 1870–79, *and during* 1880, 1881, 1882, *and* 1883.

Period.	Ratio per 1,000 of strength.											
	Bengal Proper.		Gangetic Provinces and Oudh.		Meerut and Rohilcund.		Agra and Central India.		Punjab.		Hill Stations.		Bengal Presidency.	
	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.
1860–69	1,821	29·57	1,615	28·59	1,576	26·61	2,169	38·48	1,741	25·24	1,069	14·78	1,755	29·98
1870–79*	1,311	14·43	1,410	20·06	1,461	18·31	1,530	18·41	1,847	20·71	1,044	12·23	1,522†	21·00†
1880*	1,469	16·03	1,494	29·32	2,011	22·98	1,935	15·07	2,126	36·41	1,253	20·75	1,813	27·73
1881*	1,610	12·02	1,741	15·24	1,867	47·81	1,728	10·11	1,949	23·44	1,177	9·97	1,729	17·05
1882	1,187	11·19	1,699	22·61	1,613	8·86	1,891	10·51	1,796	12·12	975	8·65	1,579	13·17
1883	1,011	9·10	1,474	17·04	1,528	10·56	1,497	14·27	1,601	9·47	1,454	6·33	1,463	11·21

* Excluding troops in Afghanistan and on the march. † Including troops in Afghanistan and on the march.

The admission-rates in the Gangetic Provinces with Oudh (1,474) and Meerut with Rohilcund (1,528) were greater than the average rates of the period 1870–79, though less than the average rates of the preceding ten-year period 1860–69; but the admission-rate in Hill Stations for 1883, namely, 1,454, exceeded both ten-year periods considerably. Indeed, the admission-rate for 1883 in the Hill Stations is the highest on record since 1870, with the single exception of the year 1879, when it was 1,560 per 1,000. Fevers were most prevalent in the Punjab, Rohilcund with Meerut; dysentery and diarrhœa in Hill Stations and Gangetic Provinces; respiratory diseases in Hill Stations, Punjab, and Gangetic Provinces; and venereal diseases in Bengal Proper. "The augmentation of sickness," says the Surgeon-General, Her Majesty's Forces, "in Rohilcund was not consequent on unhealthy conditions "within the district, but was due to the arrival of troops whose health had been greatly "deteriorated by immediately previous residence in the Punjab."

The highest mortality was recorded in the Gangetic Provinces (17·04), and Agra and Central India (14·27); but these ratios are nevertheless favourable when compared with many former years. The average death-rates in the Gangetic Provinces were 28·59 and 20·06 in the ten-year periods 1860–69 and 1870–79, and in the Agra and Central India group the ten-year averages were 38·48 (1860–69) and 18·41 (1870–79). After these two groups in order of high mortality come Meerut and Rohilcund (10·56), Punjab (9·47), Bengal (9·10), and Hill Stations (6·33). The chief causes of mortality in the Gangetic Provinces were cholera (3·92) and enteric fever (3·17). In Agra and Central India 4·26 per 1,000 of the death-rate was due to enteric fever, whilst 1·25 per 1,000 were due to each of the following—cholera, apoplexy, and hepatitis. The highest mortality from cholera was recorded as usual in the Gangetic Provinces (3·92); this was somewhat less than the average death-rate of the period 1870–79, namely, 4·24. The mortality from enteric fever varied from 1·07 in Bengal to 4·26 in Agra and Central India; and it is noteworthy that the death-rates from "other fevers" varied inversely from 1·07 in Bengal to 0·25 in Agra and Central India. In every single group, with the exception of the Punjab, the mortality from enteric fever for 1883 was greater than the ten-year average, and that from other fevers almost correspondingly reduced. Apoplexy caused the highest death-rate in the Punjab (1·93), in the Gangetic Provinces (1·66), and in the Bengal groups (1·60); it was lowest in the Hill Stations (0·25), and in Rohilcund and Meerut (0·80). Dysentery gave rise to the largest mortality in Bengal (1·07), and to the least in Punjab (0·18). Respiratory diseases gave rise to the highest rates in Agra and Central India (1·00), and Punjab (0·88), and least in Rohilcund and Meerut (0·26).

In individual stations the highest admission-rate was recorded in Attock (3,390), but excluding this and other small stations with an average strength of less than 200 men, five stations recorded over 2,000 admissions per 1,000, ranging from 3,032 per 1,000 in Amritsar to 2,563 in Peshawar. In all these five stations fevers and venereal diseases caused the largest proportion of admissions; in Delhi, Mean Meer, and Peshawar, respiratory diseases

also prevailed largely. Of 92 stations, 39 recorded higher admission-rates than the average admission-rate for the whole army of India (1,336).

The following stations, with an average strength exceeding 200, recorded the highest mortality:—Benares 39·89, Gwalior Fort 34·97, Dinapore 26·82, Delhi 24·94, Shahjahanpore 23·81, and Kamptee 23·33. In Benares, with an average strength of 376 men, 15 deaths occurred from various diseases. In Gwalior (average strength 429) of a total of 15 deaths, eight were due to enteric fever and five to cholera. In Dinapore (932 strength) there were 25 deaths, seven of which were due to enteric fever and seven to cholera. In Delhi (401) there were 18 deaths from various causes, and in Shahjahanpore (210) five deaths. In Kamptee, with an average strength of 600, there were 14 deaths, five of these due to enteric fever, three to cholera, two to hepatitis, and the remaining to various diseases. In 38 of the 92 stations the total mortality exceeded the average of the army of India. In Chakrata, Pachmarhi, Landour, Deesa, Khandalla, and Taragarh, which were occupied for only a portion of the year, there were no deaths; and the same remark applies to Purandhar, Baroda, Malliapoorum, and Calicutt, which were occupied during the entire year by a small body of men.

There were 9,035 men located in the hill stations of Bengal Presidency, or 26·51 per cent. of the average strength of the army. In 1882 the percentage was 27·44 and in 1881 25·3. The general health of men in the hills was not so good as it had been during the preceding year, for whilst in 1882 the admission-rate was 975 per 1,000, during 1883 it was 1,454 per 1,000. This admission-rate is unusually high, the average ratio for 1870–79 having been 1,044. The sickness represented by these figures cannot, however, have been of a severe nature, for the total mortality fell from 8·65 in 1882 to 6·33. This death-rate is the lowest on record since 1870, the nearest approach to it being in 1877, when it was 6·49.

In the Rajputana-Malwa group, which is the first belonging to the Bombay Command, the statistics are very favourable. The admission-rate was 1502 as compared with an average admission-rate of 1,614 during 1870–79, and the death-rate 8·32 as compared with an average of 17·41 during the same ten-year period. The admission-rate of the year, though on the whole favourable, was higher than it was during the years 1873–77, when it ranged from 1,244 to 1,492. The total death-rate of the year 1883 was by far the most favourable on record since 1870, and was less than one-half the average of the ten-year period. The chief components of this total death-rate, which includes 0·43 due to cholera, were 1·07 from enteric fever, 0·85 apoplexy, 0·64 dysentery, and 0·85 hepatitis. The highest admission-rates were recorded in Indore (2,026) and Baroda (2,006); both are small stations; the former with an average strength of 115, and the latter of 168. The largest station, Mhow (1,239), had an admission-rate of 1,822, and a total death-rate of 8·07. The highest death-rates were recorded in Indore (17·39), and Karachi with Ghizree (16·34).

The strength of the European Army in the Deccan and Nagpur group was considerably smaller than in 1882,—6,994 against 7,685. The admission-rate was 1,001 (the lowest on record since 1870) against 1,029 in 1882, and an average of 1,383 during the ten-year period 1870–79. The mortality, however, (10·72), was higher than it was in 1882 (7·94). This last ratio was exceptionally low, the average mortality for the ten-year period having been 14·14. The chief causes of admission were venereal diseases, which caused 265 per 1,000 of the total admission-rate, and intermittent fevers, which caused 191 per 1,000; whilst the chief causes of mortality were enteric fever (2·72), cholera (1·72), "other fevers," hepatitis and respiratory diseases, each causing 0·71 per 1,000. Of the 11 stations comprised in this group, five recorded higher admission-rates than 1,000 per 1,000. Poona and Secunderabad, with average strengths of 1,087 and 2,281, respectively, are the largest stations. The admission-rate in Poona was 973, and in Secunderabad 811. No less than 327 of the total admission-rate at Secunderabad were due to venereal diseases. The highest death-rates were recorded in Asirgarh (24·00), Kamptee (23·33), Kolhapur (22·99), and Satara (20·98). With the exception of Kamptee, where an average strength of 600 men was quartered, the stations mentioned are small, and a few deaths gave rise to the large ratios. In Kamptee, of a total of 14 deaths, five were due to enteric fever and three to cholera. The death-rates in Secunderabad and Poona were 8·33 and 7·36, respectively. Of the Secunderabad mortality, 2·19 were due to cholera; there was no cholera mortality in Poona. The mortality in Poona exceeded that of the previous year, which had been only 2·85; an unusually low rate. The average death-rate in this station for 1870–79 was 11·91, whilst the average ratio for Secunderabad during the same period was 19·95.

The average strength of the force located in Southern India was 4,661. The admission-rate (1,126) was somewhat greater than it had been in 1882 (1,119), but below the average for 1870–79 (1,235). The total death-rate was 8·58, also somewhat higher than that of the two preceding years (7·74 in 1881 and 8·30 in 1882), but it compares favourably with the

average death-rate of the past decade (13·70). Of the total admission-rate, 339 per 1,000 were due to venereal diseases. The next highest admission-rates were for wounds and accidents (128) and intermittent fevers (89). The chief causes of mortality were enteric fever (3·44) and hepatitis 1·72. In this group seven stations are included, the largest being Bangalore with an average strength of 1,821, Bellary with an average of 985, and Cannanore with 688. Four of the seven recorded higher admission-rates than 1,000, the highest being 1,356 in Bangalore. The highest death-rates were recorded in Bangalore (11·53), Madras (7·79), and Cannanore (7·27). The death-rate at Bangalore was almost identical with the average death-rate in that station during the past decade (11·81), whilst the ratios of Madras and Cannanore were considerably below the averages, which were 12·75 and 14·90, respectively. At Bellary the death-rate was 7·11 against an average death-rate of 9·87.

The average strength in the British Burma group was 2,001. The admission-rate was 980 as compared with 1,047 in 1882, and 1,092, the average of the last decade. The total mortality was 10·00; this compares very favourably with the average mortality of the ten-year period, which was 17·32. During 1883 there were no deaths from cholera. The chief cause of mortality was hepatitis (2·50). Next to it come dysentery and injuries, each contributing 1·00 per 1,000 to the total. Only four stations are included in this group, the largest being Rangoon with an average strength of 733. The admission-rate was greatest in this station, 1,304, which was contributed to most largely by venereal diseases (266), fevers (151), dysentery (106), and hepatitis (106). The highest death-rate, 14·29, occurred in Port Blair, a small station with an average strength of 140 men; two deaths gave rise to the ratio. In Rangoon the death-rate was 10·91; of the eight deaths in this station, four were due to hepatitis.

The statistics of an average force of 811 men of the Madras and Bombay armies in the hills of these Presidencies are, on the whole, favourable. The admission-rate was 1,059 against an average rate of 1,594 during 1870–79, and the death-rate from all causes 8·63 against an average of 15·16. Both the admission and death-rates were smaller than in 1882.

Cholera. In the report for 1882 attention was drawn to the remarkable abeyance of cholera during that year; the history of 1883 is even more striking in this respect. Throughout the army of India only 82 cases of cholera were treated, or a ratio of 1·5 per 1,000, and of these 51 or 0·92 per 1,000 died. During the preceding year 98 cases (1·7 per 1,000) were admitted and 61 (1·07) died. The mortality among those seized was 62·20 per cent. against 62·24 in 1882. These favourable results for the army, as a whole, have been mainly due to the small number of cases which occurred in the Bengal Presidency, for the admissions and deaths in the other two Presidencies were somewhat more numerous than they had been in 1882. In the Bengal Presidency only 48 cases occurred with 32 deaths against 73 cases and 45 deaths in 1882. These results, though very favourable, are, however, by no means the most favourable on record, for since 1860 fewer cases, both absolutely and proportionally, were admitted in the three years, 1871, 1874, and 1877. The admission-rate per 1,000 was in the Bengal Presidency 1·4 against 5·9 in 1870–79 and 14·7 in 1860–69. The death-rate per 1,000 was 0·94 against 4·18 during 1870–79 and 9·24 during 1860–69, and the percentage of deaths among those seized was 66·67 against an average of 62·72 during 1860–69 and of 70·26 during 1870–79. Whilst these average ten-year ratios show that both the prevalence and mortality per 1,000 have greatly diminished of late, the percentage of deaths amongst those attacked has risen. Eleven individual years between 1860 to 1879 show a smaller percentage of deaths among those attacked than the percentage of 1883. In the Madras Army 19 cases occurred with 10 deaths, yielding admission and death ratios of 1·8 and 0·95 per 1,000, respectively. The average admission and death-rates during 1870–79 were 2·9 and 1·68. The reduction in the ratios of the year under review, as compared with this ten-year period, was therefore not so great as in Bengal. The percentage of mortality among those treated was 52·63 against an average percentage of 58·49 during 1870–79. In the Bombay Army 15 cases with nine deaths were recorded, or 1·4 per 1,000 of admissions and 0·82 of deaths. These results are not so favourable as those of the three preceding years, but are better than the average ratios of the ten-year period, which gave an admission-rate of 2·1, and a death-rate of 1·53. Of those treated in this Presidency, 60·0 per cent. died against an average percentage of 73·27 during the last decade.

With regard to the distribution of the disease in the several geographical groups of the Bengal Presidency, it may be noted that the largest number of cases and deaths occurred in the Gangetic Provinces with Oudh. The admission-rate in these Provinces was 5·9 per 1,000 and the death-rate 3·92. In three of the six groups, including the Hill Stations, there was an entire absence of the disease, whilst in Bengal Proper only one case occurred. A similar but greater preponderance of cases in the Gangetic Provinces was observed in 1882.

Small-pox. Small-pox was more than ordinarily prevalent in the army of India. There were in all 105 cases as compared with 44 in 1882, and nine deaths against four. The admission-rate

was 1·9 per 1,000 of strength as compared with an average of 0·7 during 1870–79, and a death-rate of 0·16 against an average death-rate of 0·10 during the same period. The percentage of deaths amongst those attacked was low (8·57) against an average of 14·71 during 1870–79.

The increased prevalence of the disease in the army of India was mainly due to its increased prevalence in Bengal. There were 86 cases admitted, the largest number recorded in any year since 1870, and exceeded only in the years 1860, 1861, 1864, 1865, and 1869. The admission-rate per 1,000 of strength in the Bengal Presidency was 2·5, compared with an average admission-rate of 2·2 during 1860–69 and 0·8 per 1,000 during 1870–79. All but five of the cases occurred between January and May, the driest part of the year, and the year itself was one of the driest on record for many years. The death-rate per 1,000 of strength (0·21) was nearly double that of the period 1870–79, but was below the average death-rate of the preceding ten-year period 1860–69. Although the prevalence of the disease in the army of the Bengal Presidency was considerably greater than usual, it is satisfactory to be able to note that the mortality (7) amongst those attacked was only 8·14 per cent. against an average of 15·3 during 1870–79 and 15·57 during 1860–69. Of the 86 cases which occurred in the Bengal Army, 47 occurred in the Gangetic Provinces with Oudh, and 39 in the Agra and Central India groups. Of the seven deaths, four took place in Lucknow, and one in each of the following stations:—Shahjahanpur, Agra, and Jubbulpore. In the Madras Presidency the admission-rate was 0·9 against 0·5 in 1870–79, and the death-rate 0·10 against 0·09. Here, too, the disease was more than usually prevalent, and the mortality amongst those attacked 11·11 per cent. greater than it was in Bengal. In the Bombay Presidency the admission-rate was 0·9 against the decennial average of 0·6, and the death-rate 0·09 against 0·05. The mortality amongst the attacked was 10·0 per cent.

Fevers.

There was a great diminution in the prevalence of intermittent fever during the year. For the army of India, as a whole, the admission-rate was 359 and the death-rate 0·05. During the preceding year (1882) these ratios were 494 and 0·07, respectively, whilst the average admission and death-rates for 1870–79 were 389 and 0·14. The admission-rate in Bengal, which has risen of late years, fell during 1883 to 425 per 1,000, a ratio identical with the average admission-rate of the past decade. The death-rate was 0·03, the same as that of the preceding year, and considerably below the average rate during 1870–79 (0·17). In the Madras Army these fevers were least prevalent. Here during 1883 the admission-rate was only 99 per 1,000 against 146 in 1882 and 140, the average rate during 1870–79. There were no fatal cases. In Bombay the admission-rate (405) was less than one-half what it was in 1880, and more than 100 per 1,000 less than it was during 1882. The death-rate, continued to be high, namely 0·18 against 0·16, the average death-rate during 1870–79. It was, however, smaller than that recorded in 1882. The prevalence of intermittent fever was greatest in the Bengal Presidency, and of the several groups in this Presidency the admission-rates were highest in the following:—Punjab 546 per 1,000 Meerut and Rohilcund 539, and Agra with Central India 507. In the Gangetic Provinces the admission-rate was 256, and in Bengal Proper 134.

The admission-rate from remittent and continued fevers for the army of India equalled 49 per 1,000—a lower rate than that of the preceding year (53), and a great improvement upon the average of 1870–79, which was 162. The total death-rate was 0·41 against 0·61 in 1882 and 0·65 in 1881. In all the three Presidencies the admission-rates during 1883 were considerably less than the average rates of the past ten-year period. Compared with the preceding year the admission-rate in Bengal (62 per 1,000) was practically the same: in Madras (30) it was a little higher; in Bombay (31) it was considerably less.

Enteric fever.

The tendency to return an increasing number of continued fever cases as enteric fever year by year has been frequently noted in former reports. The results of the year under review show that that tendency still continued. In the army of India 429 cases of fever were recorded as cases of enteric fever against 357 in 1882. These numbers yield ratios of 7·7 per 1,000 of admissions in 1883 and 6·2 per 1,000 for 1882. During 1883, 133 died of the disease, or 2·40 per 1,000 against 2·55 in 1882. Notwithstanding the greater frequency of the disease during 1883 as compared with 1882, the mortality was therefore less. From 1870 to 1877 the admission-rate fluctuated between 2·8 and 4·6, and during this time the mortality per cent. of those attacked varied from 50·88 to 39·49, or a mean of 43·73. In 1878 the admission-rate rose to 8·5 per 1,000, or almost double the highest rate recorded during 1870 to 1877, and continued high during 1879 (8·0) and 1880 (7·9); the death-rate per cent. of those attacked remained much the same as it was during the period 1870–77, for it varied from 43·01 to 46·17, or a mean of 44·72. During 1881 the admission-rate again fell suddenly to 5·6; but the percentage of deaths somewhat increased (47·26).

During 1883 the admission-rate again rose to a high ratio (7·7), but the death percentage was only 31·00, the lowest on record since 1870. In the following table the admission and death-rates from enteric fever and other fevers in the three Presidencies are contrasted :—

Period.	Bengal.						Madras.						Bombay.					
	Admissions per 1,000.			Deaths per 1,000.			Admissions per 1,000.			Deaths per 1,000.			Admissions per 1,000.			Deaths per 1,000.		
	Enteric Fever.	Other Fevers.	Total.	Enteric Fever.	Other Fevers.	Total.	Enteric Fever.	Other Fevers.	Total.	Enteric Fever.	Other Fevers.	Total.	Enteric Fever.	Other Fevers.	Total.	Enteric Fever.	Other Fevers.	Total.
1870-79*	5·3	607·3	612·6	2·22	1·74	3·96	5·8	280·5	270·4	1·62	0·93	2·04	3·1	659·9	663·0	1·78	1·14	2·92
1880†	5·7	339·6	345·3	3·07	2·66	5·73	2·6	440·1	452·7	1·36	0·39	1·75	9·5	1,117·3	1,126·8	3·76	3·32	3·99
1881†	6·3	783·9	770·2	2·62	3·81	3·43	0·9	278·7	279·6	0·58	0·19	0·77	4·2	840·6	844·8	2·83	0·91	3·74
1882	7·3	600·0	667·3	2·90	0·77	3·67	4·0	171·5	175·5	2·09	0·27	2·36	5·1	558·5	563·6	1·80	0·83	2·71
1883	8·1	486·4	494·5	2·52	0·44	2·96	8·6	128·4	137·0	2·36	0·28	3·14	5·7	436·4	442·1	1·55	0·73	2·28

* Including troops on active service and on the march. † Excluding troops in Afghanistan.

In 1880 the Bombay Presidency recorded the highest admission-rate (9·5) : during 1881 and 1882 the Bengal Presidency took the first place in this respect with admission-rates of 6·3 und 7·3, respectively; but during 1883 the Madras Presidency records the highest admission-rate (8·6), or more than twice the ratio it recorded in 1882 (4·0). But that the severity of the disease in this Presidency was much less, is indicated by the fact that whilst in 1882, 52·27 per cent. of those attacked died, in 1883 this ratio fell to 33·33 per cent. The next highest admission-rate occurred in Bengal (8·1), and the smallest in Bombay.

The absence of any definite relationship between the admission-rates for enteric fever and for other fevers, as may be seen from the above table, was noted in the report for 1882 : the addition of another year's figures serves to strengthen this conclusion.

The largest number of cases was admitted during July to October (214 cases), and the smallest during November, December, January and February (70). During the hot and dry months, March, April, May, and June, 145 cases were admitted.

The highest mortality per 1,000 of strength was recorded in Madras, 2·86, the next in Bengal, 2·52, and the least in Bombay, 1·55. The high mortality in Madras is unusual, as may be seen in the following table in which the death-rates from this disease and from other fevers are given for a series of years :—

Presidencies.	Fevers.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	1880.	1881.*	1882.	1883.
Bengal	Intermittent, remittent, and continued.	2·25	1·78	1·39	1·10	1·18	0·71	0·56	1·59	2·63*	2·66*	0·81	0·77	0·44
	Enteric	1·71	1·62	2·53	2·01	1·59	1·75	1·85	4·69	3·86*	3·07*	2·62	2·90	2·52
	Total	3·96	3·40	3·92	3·11	2·77	2·46	2·21	6·28	6·49*	5·73*	3·43	3·67	2·96
Madras	Intermittent, remittent, and continued.	0·83	0·69	0·70	0·17	0·36	0·46	0·27	1·11	0·76	0·39	0·19	0·27	0·28
	Enteric	1·47	2·34	0·78	1·04	0·63	1·99	2·00	1·20	1·44	1·36	0·58	2·09	2·86
	Total	2·30	3·03	1·48	1·21	0·99	2·45	2·27	2·31	2·20	1·75	0·77	2·36	3·14
Bombay	Intermittent, remittent, and continued.	1·01	0·74	0·58	0·76	1·28	0·29	0·50	1·12	1·61	3·23	0·91	0·81	0·73
	Enteric	1·48	2·22	4·31	1·35	1·27	1·86	1·39	2·55	1·93	5·76	2·83	1·90	1·55
	Total	2·49	2·96	4·87	2·09	3·05	2·15	1·89	3·67	3·54	8·99	3·74	2·71	2·28

* Excluding troops in Afghanistan.

The mortality in Madras for 1883 is the highest on record since 1870, the next highest ratio having been recorded in 1872, viz., 2·34. The average death-rate in Madras during 1870–79 was 1·42, but it is made up of variations from 0·63 to 2·34. The mortality in Bengal for 1883 (2·52) is but little greater than the average ratio for 1870–79, viz., 2·28. Here, also, this average ratio is made up of extremes from a minimum of 1·53 (in 1873) to 4·69 (in 1878). The Bombay death-rate is fractionally less than the ten-year average, which is 1·75.

In the report for 1882 it was remarked that although enteric fever had been added as a new form of fever to the nomenclature of Indian diseases, no increase in the mortality of fevers as a whole had resulted, and that whilst the mortality from enteric fever had, of late years gradually increased, so the mortality from other fevers had almost correspondingly decreased. The experience of the year 1883 is to a like effect. In the following table it will be seen that the total mortality from all fevers, including enteric fever during 1883, was

less than the average total mortality of 1870–79 in all Presidencies, with the exception of Madras, in which it was slightly greater. The table also illustrates forcibly the proposition that together with an increasing mortality from enteric fever there has been a reduction in the mortality from other fevers:—

Mortality from Enteric Fever and other Fevers.

	During 1870-79.			During 1883.		
	Enteric fever.	Other fevers.	Total of both.	Enteric fever.	Other fevers.	Total of both.
Army of India	2·03	1·42	3·45	2·40	0·46	2·86
„ Bengal	2·28	1·74	4·02	2·52	0·44	2·96
„ Madras	1·42	0·62	2·04	2·86	0·28	3·14
„ Bombay	1·75	1·14	2·89	1·55	0·73	2·28

The largest number of cases in any one station occurred in Lucknow, 44 cases were admitted, and of these eight died or 18 per cent. In Bangalore 40 cases were admitted, and 11 proved fatal, or 27 per cent; 26 cases occurred in Secunderabad with seven deaths (27 per cent.); 25 in Karachi with only two deaths (8 per cent.); 22 in Subathu with two deaths (9 per cent.); 18 in Meean Meer with two deaths (11 per cent.); 15 in Morar with seven deaths (46 per cent.); 13 in Dinapore with seven deaths (54 per cent.); 13 in Ferozepore with five deaths (38 per cent.). In Sitapur, which during the preceding year returned the largest number of admissions (45), there were only 10 cases with two deaths (20 per cent.)

The relationship between enteric fever and age has been so fully discussed in former reports that it is unnecessary to repeat in detail the facts there brought forward. It will suffice to reproduce the tables given in former reports with the figures and ratios for 1883 added:—

Composition of the Army of India according to age, 1871–83.

Year.	Under 25.	25 to 29.	30 and upwards.	
1871—75	38 per cent.	27 per cent.	35 per cent.	= 100
1876	33 „	33 „	34 „	= 100
1877	33 „	35 „	32 „	= 100
1878	35 „	36 „	29 „	= 100
1879	39 „	33 „	28 „	= 100
1880	41 „	34 „	25 „	= 100
1881	43 „	35 „	22 „	= 100
1882	41 „	36 „	23 „	= 100
1883	41 „	35 „	24 „	= 100

The proportions of men at the different ages are almost identical with those of the preceding year.

Statement showing the Death Ratios of the European Army from Enteric Fever at different ages, together with Ratios of Liability to it for 1877–83.

Year.	Mortality from Enteric Fever and Ratio of Liability to it at Different Ages.					
	Under 25.		25 to 29.		30 to 34.	
	Deaths per 1,000.	Percentage of liability.	Deaths per 1,000.	Percentage of liability.	Deaths per 1,000.	Percentage of liability.
1877	2·45	44·2	1·55	27·9	0·99	17·8
1878	6·04	53·0	3·55	31·1	1·04	9·1
1879	6·17	54·1	2·73	23·9	1·78	15·6
1880	6·25	56·26	3·15	28·35	1·09	9·81
1881	4·56	59·84	1·57	20·60	0·79	10·37
1882	4·32	56·18	1·55	20·16	0·78	10·14
1883	4·34	66·36	1·50	22·94	0·70	10·70

The figures for 1883 show that both the mortality from enteric fever and the ratio of liability to it are by far the greatest among young soldiers under 25 years of age. The mortality among these young soldiers was 4·34, whilst for men between 25 and 29 and from 30 upwards it was only 1·50 and 0·70, respectively. The percentage of liability among young soldiers under 25 years was 66·36, the highest on record since 1877, and 10·18 per cent. higher than it was in 1882. The percentage of liability rapidly falls with increasing age. For men between 25 and 29 it was 22·94, and for men above that only 10·70.

The relationship between enteric fever and length of Indian service has also been frequently discussed in former reports. As shown in the following tables, the results of 1883 fully bear out former conclusions that the disease attacks soldiers of short residence in India in much greater proportion than others, and further show that the greater the proportion of young acclimatized men in the army of short residence in India, the greater is the liability of the army to loss from this disease :—

Statement showing the Proportion of Men who have served in India, two, five, and seven years from 1871–83.

Period.	Percentage of Men to Total Strength who have served in India.			Period.	Percentage of Men to Total Strength who have served in India.		
	Two Years and under.	Five Years and under.	Seven Years and under.		Two Years and under.	Five Years and under.	Seven Years and under.
1871	36·2	64·6	78·9	1878	28·9	59·8	73·0
1872	33·7	66·7	80·9	1879	32·1	60·9	72·6
1873	31·7	65·5	79·6	1880	33·4	65·4	77·2
1874	25·9	64·3	79·8	1881	38·9	70·4	81·1
1875	26·1	60·1	81·0	1882	33·1	71·9	82·9
1876	25·5	57·6	75·1	1883	32·3	74·7	85·5
1877	25·2	56·2	72·6				

From these figures it appears that in 1883 out of every 100 men only 14·5 had served longer than seven years.

Statement showing the Death Ratios of the European Army from Enteric Fever at different periods of residence in India, together with Ratios of Liability to it for 1877–83.

Year.	Mortality from Enteric Fever, and Ratio of Liability to it at Different Periods of Residence in India.					
	1st and 2nd Years.		3rd to 6th Year.		7th to 10th Year.	
	Deaths per 1,000.	Percentage of liability.	Deaths per 1,000.	Percentage of liability.	Deaths per 1,000.	Percentage of liability.
1877	3·31	59·5	1·35	24·2	0·90	16·1
1878	7·90	63·4	2·64	21·2	1·38	11·0
1879	7·99	67·2	2·18	18·3	1·24	10·4
1880	9·06	75·98	1·78	14·90	0·47	3·93
1881	4·55	66·02	2·07	27·31	0·56	7·39
1882	4·68	61·10	1·93	25·19	0·34	4·44
1883	4·98	70·34	1·55	21·89	0·55	7·77

In Bengal Proper three cases of enteric fever occurred, one in January, one in June, and one in October. In the Gangetic Provinces with Oudh there were two periods of prevalence, one culminating in May (12 cases), the other in September (15 cases). The culmination in May was rapidly reached from 3 cases in March, but that of September more gradually, for the cases rose from 0 in June through 4 in July and 9 in August to 15 in September. In the Gangetic Provinces the disease was least prevalent in March, June, and November. There was also a slight rise during December and January. In Agra and Central India there was one period only of increase, in August, when 13 cases were admitted; the cases fell in September to 8, and in October to 1. In the Punjab there was a gradual increase in the number of cases, from 8 in March and 11 in April to 16 in May; thereafter the disease

subsided gradually, until only 1 case occurred in August. Another smaller rise began in September, culminating in November (9 cases). During December, January, and February, there were very few cases :—

Monthly Distribution of Admissions from Enteric Fever in 1870–79, 1880, 1881, 1882, *and* 1883.

Groups.	Period.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Bengal Proper	1870-79	2	6	5	1	4	2	3	4	7	2	8	2	39
	1880	—	1	—	—	—	—	—	—	—	—	—	—	1
	1881	—	—	—	—	7	2	3	1	—	—	—	—	13
	1882	—	1	—	2	—	—	—	—	—	1	1	1	6
	1883	1	—	—	—	—	1	—	—	—	1	—	—	3
		3	8	5	3	11	5	6	5	7	4	9	3	—
Gangetic Provinces	1870-79	38	25	22	72	74	44	33	43	55	26	19	35	486
	1880	2	2	2	15	6	5	3	2	3	12	4	2	53
	1881	1	—	10	10	9	6	—	5	—	5	10	3	64
	1882	2	5	17	22	26	12	1	16	3	2	8	2	124
	1883	8	5	3	12	12	—	4	9	15	7	3	5	82
		51	37	54	130	127	67	41	75	86	52	44	47	—
Rohilcund and Meerut.	1870-79	12	6	9	28	71	22	11	12	36	17	12	15	251
	1880	1	1	7	15	8	6	1	1	—	1	1	1	43
	1881	1	—	1	4	11	2	2	2	1	3	2	2	31
	1882	—	—	3	4	6	4	4	1	2	1	1	—	27
	1883	1	—	1	7	2	2	5	—	4	3	1	1	31
		15	7	21	59	98	36	23	16	43	25	17	19	—
Agra and Central India.	1870-79	8	6	10	20	14	8	4	13	46	32	15	8	179
	1880	1	1	2	—	—	1	—	2	—	3	6	—	16
	1881	2	1	2	3	7	—	2	3	7	3	3	1	33
	1882	—	—	1	2	3	—	—	9	6	1	—	—	22
	1883	1	1	—	1	2	1	1	13	8	1	1	1	27
		12	9	15	26	26	5	7	39	67	40	25	10	—
Punjab	1870-79	28	23	32	44	88	89	59	42	44	38	24	30	536
	1880	5	3	6	4	8	20	3	8	6	5	5	3	76
	1881	1	1	3	5	13	5	3	5	6	2	4	7	55
	1882	—	1	3	3	6	7	1	3	7	5	4	2	44
	1883	3	2	8	11	16	11	9	1	5	4	9	1	80
		37	30	52	67	126	132	75	61	68	54	46	43	—

The reports by medical officers of cases occurring under their treatment, show, as usual, how indefinite are the symptoms which are often presented by cases of this kind. In numerous instances the patients were admitted primarily as suffering from ordinary remittent fever and even febricula. Thus one medical officer writes :—"Many of the cases were "admitted for febricula, and after a few days changed to enteric fever." Another writing of his cases says :—"The eruption characteristic of enteric fever is in this country more often "absent than present; diarrhœa invariably absent until the disease is very advanced and "ulceration has set in; pulmonary complications severe, congestion of the lungs sets in early; "and so marked was this in one case, that one of the most accurate observers and painstaking "medical officers I ever met, diagnosed an admission as a case of pneumonia, one that died "of a most virulent form of enteric fever in seven days." Again, in Morar, 15 cases were admitted against three in the preceding year, and the medical officer, after discussing fully the difficulties attending the diagnosis of a case of enteric fever from one of an ordinary continued or remittent type, expresses his belief that during the preceding year cases of enteric fever were included among cases of remittent and continued fevers. The extreme variations in the duration of cases, both of those which recovered and those which ended fatally, noted in the report for 1882, is again observable in the reports of 1883. In Umballa the average duration of the cases which terminated favourably was 43 days; but one case ended fatally on the second day. At Morar, a case was recorded, which ended fatally 36 hours after admission; the patient, it is stated, was "a man whose constitution had been "evidently debased by frequent ague attacks and drinking; and although the intestines showed "no positive ulcers, the glands and Peyers patches were inflamed, and their surroundings

" tumefied, giving reason to the belief, that had he not died at so early a stage, they would in " a very few hours have presented the usual ulcers." As the symptoms of this fever are so indefinite, it is not surprising to find an extreme amount of variation in the death-rate per cent. of those attacked. In other words, whilst some medical officers regard only those cases as enteric fever, which present the gravest symptoms, others include cases of much simpler character. Omitting those hospitals in which only a very few cases were recorded, and confining attention to those in which the largest numbers occurred, it will be found that the mortality per cent. of those treated varied from 8·00 at Karachi, where 25 cases were treated, to 27·50 at Bangalore, where 40 cases were treated. At Gwalior Fortress, where, however, only 12 cases were treated, 8 died, yielding a percentage of 66·6. At Subathu, of 22 cases treated, 2 died (9·09 per cent.), and of 1 of these it is noted, that " the temperature " chart varies greatly from the usual outlines of enteric fever," while in the report of the *post mortem* appearances found, it is stated, the " Peyers patches were intact." With regard to the etiology of the disease, no positive results of any value were arrived at. Most medical officers note the improbability or impossibility of fæcal contamination of the food or water of the soldiers. Similarly, no fault is found with the sanitary condition of the barracks. In a few cases, fanciful probable causes of the disease are stated. For example, one medical officer writes :—" No cause was assigned at the time, but afterwards, as the tank water used " for the tatties frequently emitted a most offensive and putrid odour, I came to the conclusion " that this in drying upon the tatties was most probably the cause." Another writes, that the milk is open to suspicion, as dirt from the udders of cows got into the milk while they were milked, and he proceeds :—" If filth be regarded as a source of typhoid fever, this is a " very possible source of danger." Several cases which occurred in Meean Meer were attributed to the use of " pop and milk brought round by natives." At another place the outbreak is attributed to a breach in an aqueduct. The medical officer presumes that this aqueduct " was utilised for washing their clothes, and bathing in," and a senior officer criticising this, says :—" This opinion is confirmed by the fact of the absence of enteric fever " after the breach in the aqueduct was closed." The influence of youth and short residence " in India, on the other hand, is abundantly evident. It will suffice here to quote in illustration, the facts in this respect at Lucknow, where 44 cases occurred in all. Of these, no less than 35 occurred among men of the Derbyshire regiment, which arrived in India from Egypt on 24th November 1882, and which was principally composed of very young soldiers. Of the 44 cases which occured in Lucknow, 33 occurred in men between 20 and 24 years of age, and nine in men from 25 to 29: 33 had been less than a year in India, and five over one year but less than two years. With regard to infection as a cause of the disease, most medical officers were unable to adduce any evidence. One medical officer writes :—" The " idea of infection cannot be held, as five of the cases occurred in different months and could " have had no relation to each other; of the remaining four, though they all occurred in the " same month, namely, November, two were stationed in opposite ends of cantonments, and " of the other two, one had just come down from the hills, the other had recently arrived in " the station from England." At Jubbulpore three cases occurred, all fatal, and all from different localities: they " could not be traced to any common cause in water, milk, or " individual locality." At Lucknow, where as already stated, so many cases occurred, the medical officer records that " even in the barracks occupied by the regiment which supplied " most of the cases, there was no marked prevalence in any one building or locality." Lastly, at Cherat, of the seven cases which occurred " three belonged to the same company, " but came from different tents; other three cases from the same regiment came from different " companies and from localities widely apart." It has already been noted above that 40 cases occurred at Bangalore. The Surgeon-General, Her Majesty's Forces, Madras, in his report on enteric fever amongst British troops in the Madras Command for 1883, quotes the medical officer's views as to the probable causes of enteric fever there as follows :—" No insanitary " defects could be discovered within the barracks. The water-supply (mixed water from the " Ulsoor tank and dhobies' wells as usual) was impure from contamination by excrement and " filth of every description. There is not only the immediate danger from the pollution of " the water-supply tank, but as a portion only of the filth washed into it becomes oxidised " and innocuous, the remainder is deposited on the bed of the tank ready to give forth in the " dry season, when the water is low and the bed of the tank (125 acres in extent) is exposed " to the sun, the noxious vapour which in conjunction with the use of the water predisposes " to, if they do not directly cause, this fatal form of fever." And the Surgeon-General remarks :—" The conditions referred to in these extracts are, in my opinion, sufficient to " account for the prevalence of enteric fever at Bangalore." The unsatisfactory nature of the water-supply at Bangalore has often been noticed. The subject was again under the consideration of the Madras Government, who had received an exhaustive report from an officer specially deputed to investigate the whole question.

Throughout the army of India there was a slight diminution in the prevalence of dysentery. The admission-rate was 27 per 1,000 as compared with 29 in 1882, and 40 the average rate of the past decade. Diarrhœa, as estimated by the admission-rate, was exactly the same as it had been in 1882; in both years the admission-rate being 46. This ratio is, however, considerably less than the average ratio for 1870–79, 63 per 1,000. Together with the great reduction in these diseases as compared with the past decade, it is noteworthy that the severity of the disease was also less. The percentage of deaths amongst those treated for dysentery was 1·40, whilst the average percentage was 3·65; for diarrhœa it was in 1883, 0·68 against an average of 0·19. In both, therefore, the percentages of 1883 were much less than the average ratios. The total death-rate per 1,000 of strength was 0·38 in the case of dysentery and 0·04 in diarrhœa. Both ratios are smaller than those for the preceding year, and the average ratios of 1870–79. Dysentery, as usual, was most prevalent in Madras and least prevalent in Bombay, the admission-rates being 49 in Madras, 23 in Bengal, and 18 in Bombay. Bowel complaints.

The highest death-rate per 1,000 of strength occurred in Bombay, 0·55, where the admission-rate was least. The ratio considerably exceeds that of the preceding year, which was 0·18. The smallest death-rate occurred in Madras, 0·28, where the admission-rate was greatest. This death-rate is an improvement upon that of the preceding year (0·36), and is the lowest on record since 1870. In the Bengal Army the death-rate, 0·35, is also the lowest on record (since 1868). Diarrhœa was most prevalent in Bengal (admission-rate 49). In Madras the admission-rate was 45 and in Bombay 39. The variations are not so great as in the case of dysentery; all ratios are considerably below the average ratios of 1870–79. The mortality from diarrhœa was trifling; it was 0·06 in the Bengal Army, and there were no deaths from the disease in the other two Presidencies. For the whole army of India the mortality was one-third the average mortality during 1870–79.

In comparison with 1882 there was a somewhat increased prevalence of, and mortality from, apoplexy. The admission-rate for the whole army of India equalled 3 per 1,000 against 2, and the death-rate was 1·10 against 0·85 in 1882. The increased admission-rate was due to an increase in the Bengal Army, as the admission-rate in the Madras Army was less than it had been in 1882, and that of the Bombay Army was the same. The increased total mortality also was due to an increase in the Bengal and Bombay Armies. The admission-rate in the Bengal Army, 4 per 1,000, is however identical with the average admission-rate for the last two decades, and the death-rate, 1·32, was below the averages of those periods. In the Madras Army both the admission and death-rates (1 and 0·38 per 1,000 respectively) were considerably less than the average rates. In the Bombay Army the admission-rate (2 per 1,000) was one-half the average of the past decade, but the reduction in the death-rate (1·10 for 1883) was not so great. Apoplexy.

Hepatitis in the army of India was in much the same proportion as in the preceding year. The admission-rate was 29 against 30 in 1882. The death-rate was 1·13 against 1·40 in 1882. Both the admission and death-rates were much smaller than the average ratios of the last ten-year period, and are the lowest on record since 1870. The disease was most prevalent in the Madras Army. Here the admission-rate was 41 per 1,000 and the death-rate 1·72, but these ratios are, on the whole, unfavourable as compared with the ratios of the three preceding years; they are below the average ratios of the past decade, which were—admission-rate 67 and death-rate 3·18. The next highest admission and death-rates occurred in the Bengal Army. The admission-rate was 27 and the death-rate 1·06. These ratios are the lowest on record since 1869. The results in the Bombay Army were somewhat unfavourable as compared with the preceding year, but favourable as compared with the average results of the past ten-year period. The admission-rate was 23 against 22 in 1882 and the death-rate 0·82 against 0·81. Hepatitis.

After steadily declining since 1879 the admission-rate for respiratory diseases in the whole army of India again rose, though to a small degree, during 1883. This rate was 76 as compared with 74 in 1882, and 75 the average admission-rate for 1870–79. The mortality, however, from these diseases throughout the army of India has continued to fall. It was 0·67 against 0·75 in 1882, and 0·97 the average ratio for 1870–79. The increased admission-rate above referred to was due entirely to the greater prevalence of these diseases in the Bengal Army, for only in this Presidency was there an increased admission-rate, 88 per 1,000 against 80 during the preceding year. This rate for 1883 exceeds the average ratio of 1870–79, which was 84, and still more that of 1860–69, which was 75. The Bombay Army comes next in point of frequency of admissions. In this army the admission-rate was 73 per 1,000. This ratio is higher than the average ratio of 1870–79 (64), but it is an improvement upon Respiratory diseases.

the ratios of recent years. The admission-rate in the Madras Army was 41 per 1,000, or less than one-half that of Bengal. In Madras alone is the admission-rate lower than the average ratio for the last ten-year period. The highest death-rate was recorded in the Bombay Army, 1·01, which is greater than the ratio of 1882, and still greater than the average ratio of 1870–79, which was only 0·70. In the Bengal Army the death-rate was 0·67, one of the lowest ratios on record since 1860; better results were 0·58 in 1877 and 0·54 in 1874. In the Madras Army the mortality (0·28) was almost identical with that of the preceding year (0·27) and amongst the lowest on record. The highest admission-rates were recorded in Southern Afghanistan, 179 per 1,000, Hill Stations of Bengal, 113, and Panjab, 103, and the lowest in Deccan and Nagpur, 43, Bengal, 45, and Burma and Pegu, 46.

Venereal diseases.

From the following table, which gives the admission-rates from all forms of venereal diseases in the army of India and in the three Presidencies taken separately, it will be seen that for the army, as a whole, the admissions have steadily increased. During 1870–79 the average rate was 203; since then it has risen gradually from 250 in 1880 to 270 in 1883:—

Admissions from Venereal Diseases in the three Presidencies.

Presidency.	Admissions per 1,000.					
	1860–69.	1870–79.	1880.	1881.	1882.	1883.
Bengal	265	209	276*	276*	271	281
Madras	†	198	275	258	288	289
Bombay	†	191	269	261*	224	218
India	†	203	250	260	265	270

* Excluding troops in Afghanistan.
† The statistics of Madras and Bombay, and for the whole of India for these years are not available.

As in 1882, the highest admission-rate was again recorded this year in the Madras Army, viz., 289 per 1,000. This is practically the same as it was in 1882 (288 per 1,000), and is 91 per 1,000 greater than the average admission-rate during 1870–79. It is also the highest on record. The next highest admission-rate occurred in the Bengal Army, 281. This ratio exceeds that of the preceding year by 10 per 1,000; the average of 1870–79 by 72 per 1,000, and the average of 1860–69 by 16 per 1,000. In the Bombay Army there was a reduction in the admission-rate as compared with the last five years. It was 218 per 1,000, a ratio exceeding the average of the period 1870–79 by 27 per 1,000.

Taking the statistics of venereal disease during the last 14 years, as a whole, in protected and unprotected stations, it appears that whilst for the whole of India the admission-rate for venereal diseases was 227·0 per 1,000 in unprotected stations, it was 223·1 in protected stations. There was, therefore, a small difference in favour of the protected stations. Taking the years individually for India, as a whole, in 8 of the 14 years the protected stations recorded a smaller proportion of admissions than the unprotected. The greatest difference in favour of protected stations was 70·2 per 1,000 during 1883; for whilst the admission-rate was 341·6 per 1,000 in unprotected stations, it was 271·4 in protected stations. Of the six years in which the admission-rate of protected stations exceeded the admission-rate of unprotected stations, the greatest excess was 33·2 per 1,000 in 1872. Looking next at the statistics of the three Presidencies separately during the last 14 years, it is seen that in Bombay alone were the admissions, on the whole, fewer in protected than in unprotected stations. The average admission-rate in this Presidency for the 14 years in protected stations was 209·7, and in unprotected stations 240·7. During the 14 years since 1870, only in 1870 and 1871 did the admission-rates of protected stations exceed those of unprotected stations, and of the remaining years in which the admission-rates were in favour of protected stations, the most favourable result was exhibited in 1883, when the admission-rate in protected stations was less than that in unprotected stations by 113·7 per 1,000. In Bengal and Madras, as already stated, the admission-rates in protected stations, on the whole, exceeded the rates in unprotected stations. In Bengal the rates were for protected stations 230·9, and for unprotected stations 228·1 per 1,000. In Madras for protected stations 223·0, and for unprotected stations 186·6; whilst in Bengal, 6 of the 14 years showed admission-rate results in favour of protected stations, in Madras only 3 did so. It is thus seen, that the small difference in favour of protected stations throughout India, as a whole, is due

entirely to the favourable results of Bombay. The diminution of venereal diseases in protected stations for the army, as a whole, is quite insignificant.

Invaliding.

Throughout the army of India, 1,811 men were invalided in 1883, or an equivalent of 32·66 per 1,000 of strength. This ratio is somewhat smaller than that of 1882, 33·03, and considerably smaller than the average ratio of 1870–79, which was 43·04. With the exception of the ratio of 1880, which was 26·31, it is the lowest on record since 1870. The Bombay Army contributed the largest share to this total invaliding ratio. From this army 418 men were invalided, or a ratio of 38·08 per 1,000. This ratio is higher than that of the preceding year, 35·85, and is but little less than the average ratio of 1870–79, which was 42·79. In the Madras Army the ratio was 32·70 against 24·12 in 1882, and 48·71 the average of the past decade. The smallest amount of invaliding took place in the Bengal Army, from which 1,049 men were invalided, or a ratio of 30·89. This is the second lowest ratio on record since 1870, the lowest having occurred in 1880, when it was 22·25. During the preceding year it was 34·96; the average ratio for 1870–79 was 41·40.

From the army of India, 1,073 men were invalided for change, and 702 for discharge from the service. In the case of 36 men, no information is given as to whether they were invalided for change or for discharge. Thus 39 per cent. of the total number invalided were invalided for discharge. This is a somewhat greater proportion than in either of the two preceding years. In the Bengal Army, of the total of 1,049 invalided, 574 were for change and 475 for discharge; the latter number represents 45 per cent. of the total, which is also a higher percentage than in the two preceding years. In the Madras Army, 344 were invalided in all; of these, 205 for change, and 139 for discharge, or 40 per cent. of the total. Lastly, of the 418 invalided from the Bombay Army, 294 were for change, and only 88 for discharge, or 21 per cent. of the total. Whilst, therefore, the order of the three Presidencies as regards largest total ratios of invaliding is Bombay, Madras, Bengal, as regards the seriousness of the causes of invaliding, judged by the proportions invalided for discharge, this order is exactly reversed.

Anæmia and debility, as usual, gave rise to the largest proportion of invaliding in all three Presidencies. The ratios from these causes were 4·98 in Bengal, 5·80 in Madras, and 8·56 in Bombay. With the exception of Madras, these ratios are smaller than those of the preceding year. The average ratios during 1879–79 were—

Bengal	10·23
Madras	9·78
Bombay	12·00

Compared with these, the ratios of 1883 are favourable in all cases; but the greatest improvement is shown in the Bengal Army. In the Bengal Army the next highest ratios were afforded by phthisis pulmonalis 3·24, hepatitis 3·12, diseases of the heart and arteries 2·18; in the Madras Army, hepatitis 3·23, palpitation 2·95, dysentery 2·56, phthisis 2·19, and injuries 2·18; in the Bombay Army, palpitation 3·64, fevers (including enteric) 2·82, diseases of heart and arteries 2·73, hepatitis 2·55, and phthisis 2·28.

The amount of invaliding in the British Army, due to mental diseases, has lately engaged attention, and the total number of cases in each Presidency is shown in the margin. Statistics for the whole European Army of India are only available since 1877 inclusive. The period embraced is too short to allow of any definite conclusions being drawn from the figures, but they may usefully be analysed. The ratio of invaliding from this cause during 1883, namely, 1·55 per 1,000, was greater than in any of the preceding years since 1877. Since 1880 there has been a small but steady increase year by year in this ratio. In that year the ratio was unusually low, namely, 0·87 per 1,000, the lowest on record. It rose in 1881 to 1·28, a ratio almost identical with that of 1879, and in 1882 stood at 1·35. In the army of India during 1883, mania and melancholia, with a few cases of hypochondriasis, contributed greater numbers than in any preceding year; whilst the number invalided for dementia was less than in either of the two preceding years. The approximate average ratio of invaliding from mental diseases during the whole period, 1877–1883, is 1·21, and for the armies of the three Presidencies separately the ratios were for Bengal 1·23, Madras 1·30, and Bombay 1·07. In the army, as a whole, dementia was the most frequent form of mental disease, giving rise to invaliding; melancholia with hypochondriasis next, and mania least. The differences in the numbers invalided from these three causes varied in the three Presidencies, taking all years since 1877 together. In the Bengal and Bombay Armies the excess in the number of

Total Cases of Mental Diseases.

Year.	Bengal.	Madras.	Bombay.	India.
1877	44	14	11	69
1878	40	8	8	56
1879	51	16	6	73
1880	39	7	6	52
1881	39	18	18	75
1882	48	15	14	77
1883	54	19	13	86

cases of dementia was marked; but in the Madras Army all three forms contributed almost equally. In the Bengal Army melancholia with hypochondriasis is on the whole more frequent than mania; but in the Bombay Army both forms occur in almost equal proportions.

Of the total number invalided from the army of India, 36·55 per cent. were under 25 years of age. This is a higher ratio than usual, the ratios for the last few years having been 31·82 in 1882, 33·74 in 1881, and 35·84 in 1880. There was, however, a decrease in the percentage of those between 25 and 29 years of age as compared with the preceding year, viz., 32·36 against 35·31 in 1882. The percentage invalided between 30 and 34 years of age was 15·68 against 18·39 in 1882. With reference to the effect of length of residence in India upon invaliding, the largest percentage occurred as usual amongst men of from 2–5 years' residence. During 1883, 57·81 per cent. of the men invalided were between these lengths of service. This ratio is nearly identical with that of the preceding year, but is considerably higher than that of 1880 (36·54). The next highest percentage occurred amongst men under two years' service. This was 18·94 against 17·35 in 1882. Both these ratios are much smaller than that for 1880, which was 31·12. Whilst a greater number of men of from 2–5 years' residence have been invalided year by year since 1880, a smaller number of men under two years' service have been thus lost to the army. The excess and the diminution do not, however, balance one another. There is a greater excess of loss amongst men of 2—5 years' residence than the diminution among men of under two years' service.

The strength of newly-arrived regiments was comparatively small. It was 1,453 as compared with 3,344 in 1882. Their health statistics, as compared with those of the army generally, are more unfavourable on the whole than they were in 1882.

Experience of Newly-arrived Regiments in 1883 (*during their First Year of Indian Residence*).

—	Strength.	Ratio per 1,000 of Strength.							
		Admission-rate.	Daily Sick-rate.	Death-rate.	Deaths from				
					Enteric Fever.	Other Fevers.	Apoplexy.	Dysentery and Diarrhœa.	Hepatitis.
Army generally -	55,525	1,335·7	62·9	10·88	2·40	·46	1·10	·42	1·13
New regiments -	*1,453	1,737·8	82·6	19·96	8·95	—	4·82	—	·69

* Excluding the statistics of the men of the 2nd Derbyshire Regiment at Naini Tal.

The admission and daily sick-rates amongst newly-arrived men were considerably in excess of the same rates for the army generally. The difference in the total death-rates was also very marked, much more so than in 1882; for whilst in that year the difference amounted to 4·42, during 1883 the difference was 9·08. The death-rate from enteric fever among newly-arrived soldiers as usual was high, 8·95 as compared with 2·40 for the army as a whole, showing a difference of 6·55 compared with a similar difference of only 4·65 in 1882. Newly-arrived men suffered much more severely from apoplexy than they did in 1882. The death-rate for the army as a whole was 1·10 against 0·82 in 1882, whilst for newly-arrived men the rate was 4·82 against 0·60 in 1882. They suffered less from ordinary fevers and hepatitis. These results are brought together in the above table. It may be mentioned that the statistics given in this paragraph and in corresponding paragraphs of former reports, embrace a period of a complete year from the date of arrival of the regiments concerned in India. They differ, therefore, from the results given in the tables of the Appendix, which have all reference to the calendar year.

Sickness and mortality among women and children.

The number of women in the army of India has fallen very considerably since 1875. The strength during 1883, 3,290, has been only about one-half that of 1875 (6,335). With this decrease in the number of women there has naturally been a corresponding decrease in the number of children, the average number of children during 1883, 6,015, being also about half that of 1875, 12,359. The death-rate among women was 21·28,—a ratio somewhat greater than that of 1882, but nevertheless lower than 25·09, the average ratio during 1870–79. The death-rate for children was 46·88,—a very favourable ratio since the average during 1870–79 was 68·96. Amongst women, as usual, childbirth and

abortion caused the largest proportion of deaths. The death-rate from these causes was 3·65,—a somewhat higher ratio than usual, the average during 1870–79 having been 2·93. Phthisis gave rise to the next highest death-rate, 3·35. This is also higher than the average ratio of 1870–79, which was 2·78. Compared with the average ratios of the past decade, cholera, malarial fevers, apoplexy, bowel complaints, hepatitis, and anæmia and debility, all yielded smaller death-rates during 1883. The reduction in the death-rates from malarial fevers, cholera, and bowel complaints was most marked. Of the three Presidencies, the highest admission-rate occurred in Bengal (879), and the lowest in Madras (790); but the highest mortality was recorded in Bombay (27·30), and the lowest in Madras (16·71). In Bengal the chief cause of death was childbirth and abortion; in the Madras Army it was phthisis and sunstroke; whilst in Bombay, childbirth, abortion, and phthisis contributed equally.

Among children the greatest number of deaths resulted from diarrhœa (8·48 per 1,000), convulsions (8·31), anæmia and debility (5·65), dentition (4·49), bronchitis and pneumonia (3·66), and tabes mesenterica (3·49). Comparing these rates with the average rates during 1870–79, the mortality from tabes mesenterica alone was greater. There was a considerable reduction in the death-rates from diarrhœa, dentition, and convulsions. Diarrhœa caused the largest mortality in Madras (9·27) and the smallest in Bombay (6·59); convulsions the largest in Madras (8·60) and the smallest in Bombay (7·53); whilst dentition caused the largest proportion of deaths in Bombay (6·59) and the smallest in Madras (3·97). Two cases of enteric fever are reported. They were both in Bengal, and both terminated in recovery. Two cases of cholera occurred—one in Bengal, which recovered, and the other in Madras, which died. Fifteen cases of small-pox occurred, two of which ended fatally.

Mortality among officers.

In former Annual Reports the statistics of deaths and causes of deaths among officers related only to the officers of the Bengal Army. Information of a similar nature regarding the officers of the Madras and Bombay Armies has been supplied by the Adjutant-General in India since 1881.

During 1881, throughout the army of India there were in all 6,509 officers, of whom 3,152 belonged to the British service and 3,357 to the Indian service. Of the officers of the British service 52 died, or an equivalent of 16·49 per 1,000. Among the officers of the Indian service 50 died, or in the proportion of 14·89 per 1,000. The mortality in both services together equal 15·67 per 1,000. In 1881 the death-rates for the Presidencies separately were as follows :—

Bengal:	both services combined	=18·85
	British service alone	=20·10
	Indian service alone	=17·48
Madras:	both services combined	=10·36
	British service alone	= 6·36
	Indian service alone	=13·11
Bombay:	both services combined	=12·76
	British service alone	=15·41
	Indian service alone	=10·46

During 1882, there were 6,163 officers of both services in the army of India. Of these 75 died, or a ratio of 12·16 per 1,000. Of the total number of officers, 3,002 belonged to the British service and 3,161 to the Indian service. Amongst the former there were in all 34 deaths, or a proportion of 11·32, and amongst the latter 41, or a proportion of 12·97. The results for the Presidencies separately are as follows :—

Bengal:	both services combined	=11·28
	British service alone	=11·02
	Indian service alone	=11·58
Madras:	both services combined	=12·89
	British service alone	= 9·82
	Indian service alone	=15·08
Bombay:	both services combined	=13·77
	British service alone	=13·89
	Indian service alone	=13·67

The total number of officers in the army of India during 1883 was 6,115, of whom 2,900 belonged to the British Army and 3,215 to the Indian Army. Among the officers of both services 75 deaths occurred, equal to a ratio of 12·2 per 1,000. 34 of these deaths were among officers of the British Army and 41 among those of the Indian Army, or in the ratios

of 11·7 and 12·7 per 1,000 respectively. The death-rates in the Presidencies separately were as follows :—

Bengal :	both services combined	= 13·22
	British service alone	= 13·90
	Indian service alone	= 12·50
Madras :	both services combined	= 11·9
	British service alone	= 6·7
	Indian service alone	= 15·5
Bombay :	both services combined	= 9·9
	British service alone	= 9·7
	Indian service alone	= 10·0

Native Troops.

Sickness and mortality in 1883.

In the Native Army of India as in the European Army, the results were on the whole favourable. The admissions equalled 923 per 1,000 and the daily sick 31. These ratios are the lowest on record since 1877, when the statistics for the whole army of India were for the first time combined. From the following table it will be seen that the ratios of 1883 are a considerable improvement upon the average ratios of the period 1877–81, and that in respect of some items they are lower than even the ratios of 1877, which was a remarkably healthy year. The total mortality in 1883 was 11·76 per 1,000, or 14·31 including men absent from their regiments. These are very favourable ratios, and are about one-half the average ratios of 1877–81. Cholera contributed a fraction more to the death-rate than in the preceding year, but the mortality under this head was, nevertheless, smaller than usual.

Year.	Average Strength.	Ratio per 1,000.				Mortality, including absent Deaths.
		Admissions into Hospital.	Daily Sick.	Deaths from		
				Cholera.	All Causes.	
1877–81	113,669	1,422	48	1·94	24·90	27·40
1877	113,966	1,030	32	1·53	16·90	13·38
1878	117,278	1,469	43	2·06	18·04	21·02
1879	121,102	1,735	58	4·61	35·15	37·79
1880	126,385	1,546	56	0·53	39·22	41·12
1881	114,612	1,305	46	0·97	19·24	22·62
1882	114,894	1,129	37	1·02	12·24	14·76
1883	114,830	923	31	1·15	11·76	14·31

Malarial fevers, as usual, gave rise to the largest number of admission, the rate for them having been 387·4 per 1,000, against 553·5 in 1882. There was, therefore, a considerable decrease of these fevers. The next lowest admission-rate recorded under this head during the previous six years was 482·6 in 1877; the highest 978·1 in 1879. After fevers, wounds and accidents gave rise to the next largest admission-rate, namely, 108·2. Dysentery and diarrhœa gave rise to an admission-rate of 60·9, or somewhat less than that of the preceding year, which was 70·1, but considerably lower than the remaining years since 1877, when it varied from 80·3 in 1877 to 177·1 in 1879. The admission-rate for respiratory diseases was 52·9. This ratio is but little greater than it was in 1877 (50·1), but considerably lower than the ratios which prevailed from 1878–81, when a large proportion of troops was engaged on active service. For enteric fever the admission-rate was 0·2, the same as it had been during the two previous years. Since 1877 there has been practically no variation in the admissions returned as due to this disease, but the degree of fatality varied considerably. The percentage of deaths among those treated was 27·78, the lowest since 1877, the highest having occurred in the preceding year 1882, when it was 58·33. Respiratory diseases, as usual, were the cause of the largest mortality, the death-rate per 1,000 having been 3·91. These diseases have of late years given rise to comparatively high death-rates. During 1879 and 1880 the rates were 10·0 and 12·30, respectively, due probably to exposure of a large number of troops whilst on active service. The ratio of 1883 does not differ much from the ratios of 1877 and 1878, which were 2·12 and 3·83. The next highest mortality resulted from fevers, namely, 1·41 per 1,000. This is the lowest rate on record since 1877; the next lowest having been, in 1882, 1·76, and the highest, in 1880, 6·73. Cholera gave rise to the next highest ratio, namely, 1·15 against 1·02 in 1882.

Bengal army.

The results as respects the Bengal Native Army which are tabulated in the following statement show that both as regards sickness and mortality the year 1883 was very favourable; the admission-rate 985, daily sick-rate 32, and death-rate 10·55 among those present with their regiments, were among the lowest on record since 1867:—

Year.	Average Strength.	Ratio per 1,000.			Mortality, including absent Deaths.
		Admissions into Hospital.	Daily Sick.	Deaths from	
				Cholera.	All Causes.	
1867–76	39,508	1,360	42	2·12	13·84	17·25
1877	39,649	1,097	34	0·35	10·32	13·63
1878	41,116	1,645	49	2·09	22·59	25·57
1879*	31,116	2,023	68	2·80	31·78	53·61†
1880*	30,365	1,609	65	1·52	33·85	53·15†
1881*	36,896	1,495	51	0·92	19·76	27·73†
1882	40,256	1,250	41	0·72	13·34	16·49
1883	40,932	985	32	0·56	10·55	13·98

* Excluding troops in Afghanistan.
† These ratios are calculated on the total regimental strength, including the army in Afghanistan.

As regards the prevalence of sickness, the admissions due to the chief diseases were less numerous than those of the preceding year, except in the cases of remittent fevers, apoplexy, hepatitis, phthisis, and wounds and accidents, but in all of these the excess during 1883 was trivial. Compared with the average admission-rates of the period 1867–76, respiratory diseases, phthisis, eye diseases, abscesses and ulcers, wounds and accidents, only gave rise to slightly higher ratios in 1883. The reduction in the admission-rate for intermittent fevers was particularly striking, namely, 398 against 606 per 1,000 in 1882, and against an average rate of 691 during 1867–76. Respiratory diseases, phthisis, and smallpox were the only diseases which gave rise to a higher mortality during 1883 than the averages of 1867–76. During 1883 the mortality from respiratory diseases was 3·20, whilst the average is 2·57, and for phthisis it was 1·07, against an average of 0·77. From smallpox the ratio was ·29 in 1883 against ·20 during 1867–76. Compared with the preceding year, however, the mortality from respiratory diseases was less. This is satisfactory as showing that the tendency to a diminishing mortality, noticed in the last two annual reports, still continued. The mortality from cholera was small; 38 cases occurred, of which 23 died, or a percentage of 60·53. The severity of the disease was therefore great. Smallpox was unusually prevalent; 50 cases were treated (1·2 per 1,000 of strength), of which 12 died, against 21 cases and 5 deaths in 1882. Enteric fever appears as the cause of 12 admissions, and of these three ended fatally, or a percentage of 25 of those treated. During the preceding year 11 cases were recorded, but seven of them proved fatal, yielding the high death percentage of 63·64. The cases of fever returned as enteric which occurred during the year under review were therefore comparatively mild.

The admission and death-rates among the troops of the several geographical groups of the Bengal Army for a series of years are given side by side in the following table:—

Year.	Ratio per 1,000.									
	Bengal Proper and Assam.		Gangetic Provinces.		Rohilcund and Meerut.		Agra and Central India.		Punjab.	
	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.
1867–76	1,523	19·13	1,062	8·38	987	11·19	1,588	9·61	1,459	14·24
1877	1,492	19·64	768	5·19	642	9·52	906	7·41	1,243	8·85
1878	1,527	22·13	1,036	7·88	1,008	9·83	1,581	12·96	1,896	18·33
1879	1,816	25·57	1,658	11·05	2,038	36·17	2,303	16·07	2,173	47·64
1880	1,757	40·63	1,222	20·50	1,395	24·46	1,884	28·52	1,687	38·02
1881	1,772	22·53	1,260	15·78	1,378	15·67	1,380	9·35	1,521	22·86
1882	1,569	18·22	1,081	10·01	1,083	9·98	1,248	7·18	1,268	13·30
1883	1,408	16·23	970	8·17	978	11·53	906	5·77	830	10·80

The results of the Agra and Central India group are again, as they were during the previous two years, the most favourable on the whole. The admission-rate in this group is certainly higher than it was in the Punjab; but the death-rate, 5·77 per 1,000, is remarkably low, being nearly one-half that in the Punjab, and one-third that in Bengal Proper and Assam. The Gangetic Provinces come next in order of favourable results. In this group the admission-rate was but slightly in excess of that in the Agra and Central India group; the excess in the mortality (8·17) was more marked. In the above table it will be seen that the average death-rate in this group during the period 1867–76 was the lowest of all the groups, and the mortality of the year under review is a little less than the average. In Bengal Proper and Assam as usual with the Native army sickness was most prevalent and the mortality highest. Comparing the death-rate of 1883 with the average death-ratios of 1867–76, the Rohilcund and Meerut group alone was in excess of the average, but the excess was small (0·34 per 1,000). In the Agra and Central India and Punjab groups the diminution of mortality was most marked: in the former group it was 3·84 per 1,000 less than the average, and in the latter 3·44. In the Gangetic Provinces and Oudh the mortality was but slightly less than the average. In the Bengal Proper group the diminution was nearly 3 per 1,000.

In every group there was a diminished prevalence of fevers as compared with 1882; this was most marked in the Agra and Central India and Punjab groups, where the admission-rates for 1883 were nearly half those of the preceding year. If the admission-rates for fevers given below are compared with the average admission-rates of the ten-year period 1867–76, it will be found that in the first group alone the rate of 1883 exceeded the average ten-year ratio. The rates in Agra with Central India and in the Punjab were considerably less than the average rates, which are 877 and 873 per 1,000 respectively. In every group bowel complaints were also less prevalent than in 1882, and still less so than the average of 1867–76. Compared with this average the diminution was most marked in the Agra with Central India and in the Punjab groups, where the admission-rates of 1883 were less than a half of the average ratios of the ten-year period (92 and 102 per 1,000 respectively). Respiratory diseases were, on the whole, less prevalent than in 1882, but only in the Punjab group was the diminution at all marked. Compared with the ten-year averages (1867–76) the admission-rate in the Punjab under this head was somewhat less; in the Rohilcund and Meerut group it was the same, but in the remaining groups the ratios of 1883 were higher.

Chief Causes of Sickness in the several Groups of Cantonments of the Bengal Presidency.

Groups.	Ratio of Admissions per 1,000 of Strength.					
	Fevers.	Bowel Complaints.	Spleen Diseases.	Respiratory Diseases.	Rheumatism.	Abscess and Ulcer.
Lower Bengal and Assam	708	181	10	74	33	79
Gangetic Provinces	336	47	5	53	48	133
Rohilcund and Meerut	418	49	3	38	33	119
Agra and Central India	321	35	7	44	33	192
Punjab	351	46	10	49	29	92

Cholera gave rise to the largest mortality in Lower Bengal and Assam; here it equalled 1·80 per 1,000 against 3·01 in 1882. The average during 1867–76 was 3·10. In the Gangetic Provinces and Oudh the death-rate from cholera was 1·17 against 0·85 in 1882, and 1·49 the average mortality of the ten-year period. In the Rohilcund with Meerut and in the Punjab groups the loss from cholera was small, and in the Agra and Central India group there were no deaths from this disease. In the preceding year all three of these groups were without any death from cholera. Fevers contributed most largely to mortality in Lower Bengal and Assam. The death-rate was 2·46 against 3·01 in 1882. There was a great reduction in the mortality from this cause in the Punjab, where the death-rate was only 0·79 against 2·11 in 1882, and an average of 3·32 during 1867–76. In every group, except Rohilcund and Meerut, the death-rate during 1883 was less than in 1882, and in that group the excess was trifling—1·90 in 1883 against 1·82 in 1882. As usual bowel complaints were most fatal in Lower Bengal and Assam. The death-rate there was 3·28 against 4·97 in 1882; but the latter ratio was greater than the average of the ten-year period 1867–76, which was 3·80. In every other group the ratios of 1883 are considerably lower than the ten-year averages. The mortality due to respiratory diseases was in all cases

less than it had been in 1882, but in all the groups, except Agra and Central India, it was greater than the averages of the ten-year period. The total mortality from all causes was highest in Lower Bengal and Assam, 16·23. Next in order come Rohilcund and Meerut, Punjab, Gangetic Provinces, and lastly Agra and Central India. With the exception of Rohilcund and Meerut, all groups compare favourably with the results of the preceding year, and with the average results of 1867–76. In this group the mortality of 1882 was 9·98, and the average mortality 11·19.

Chief Causes of Mortality in the several Groups of Cantonments of the Bengal Presidency during 1883.

Groups.	Ratio per 1,000.				
	Cholera.	Fevers.	Bowel Complaints.	Respiratory Diseases.	Total.
Lower Bengal and Assam	1·80	2·46	3·28	2·46	16·23
Gangetic Provinces	1·17	1·30	0·26	1·82	8·17
Rohilcund and Meerut	0·34	1·90	0·34	2·75	11·53
Agra and Central India	0·00	0·99	0·40	1·99	5·77
Punjab	0·07	0·79	0·72	4·97	10·80

Omitting hill stations, which were occupied only for a portion of the year, Edwardesabad was the only place in which the admission-rate exceeded 2,000 per 1,000. Here it equalled 2,217 against 2,297 in 1882. In seven stations the admission-rate varied between 1,500 and 2,000. In the preceding year six stations recorded admission-rates above 2,000, and fifteen stations between 1,500 and 2,000.

The highest death-rates occurred in the following stations:—

Edwardesabad and outposts	39·19	Mooltan	24·76
Shillong and outposts	25·92	Baxa	21·79
Dharmsala and Kangra	25·91	Dera Ismail Khan	29·81
Kohat and outposts	25·86		

There were thus seven stations in which the mortality exceeded 20 per 1,000 against 6 in 1882. In Edwardesabad, of the 70 deaths which occurred in all, 59 were due to respiratory diseases; in Kohat 45 of 65, in Mooltan 20 of 26, and in Dera Ismail Khan 23 of 40, were due to the same cause. In Dharmsala 11 of 15 deaths were due to phthisis. In Shillong and Baxa the mortality was due to various diseases.

There was a satisfactory reduction in sickness and mortality among the small body of Bengal troops serving in Southern Afghanistan. The mortality among these troops during the preceding two years was very great, but during 1883 it fell from 36·10 during three months of 1882, and 106·30 for the year 1881, to 3·21 during seven months of occupation in 1883. The average strength of the force was only 624, and two deaths, one in hospital and one out of hospital, gave rise to the ratio. The death in hospital was due to respiratory disease. The admission into hospital equalled 910 per 1,000. The chief causes of admission were intermittent fevers, wounds and accidents, and bowel complaints.

With a considerable reduction in the admission and daily sick-rates, as compared with previous years since 1877, there was an increased death-rate among men present with the Punjab Frontier Field Force as compared with the two preceding years. The chief causes of admission were intermittent fevers, respiratory diseases, abscesses and ulcers, and bowel complaints. The admission-rates for intermittent fevers, bowel complaints, and abscess with ulcers were less than the average rates during 1867–76; but the rate for respiratory diseases was greater, as under this head the rate of 1883 was 109, whilst the average for the ten years was only 66. In this force there were in all 224 deaths, of which no less than 148, or 14·18 per 1,000 of a strength of 10,438, were due to respiratory diseases. During the preceding year, out of 169 deaths, 98, or 8·77 per 1,000 were due to the same cause. The excess of mortality during 1883 over that of the preceding year was almost wholly due to the increased mortality from respiratory diseases. The largest number of these deaths took place in Kohat and Edwardesabad with their outposts, as was the case in 1882. In these stations 104 of the whole 148 occurred.

The statistics of the Central India regiments were extremely favourable. Of an average strength of 5,197 the admission-rate was 595, the daily sick-rate 19, and the mortality 7·89,

or including absent deaths 10·16. These ratios were lower than in any year since 1877; they are also favourable when compared with the average results of 1867–76, during which time the admission-rate was 1,020, the daily sick-rate 35, and the death-rate 11·10. Remittent and continued fevers gave rise to the largest number of deaths, viz., 10; whilst respiratory diseases proved fatal in 7 cases. The admissions for guinea-worm, which were remarkably numerous in 1882, were much fewer during 1883—only 88 cases against 155. More than one-half the total number of these cases occurred in the Meywar Bheel Corps, in Kherwarra.

As in the preceding year, the statistics of the Hyderabad Contingent were more favourable than those of any other section of the Native Army. The admission and daily sick-rates (572 and 20 per 1,000 respectively of an average strength of 6,983) were lower than in any year since 1877, while the mortality (7·59 per 1,000, and including absent deaths 9·31), though still very low, was much greater than the exceptionally low mortality of the preceding year (4·47). The greater mortality during 1883 was due mainly to a larger number of deaths from cholera, diarrhœa, hepatitis, and anæmia.

Madras army.

The health of the Madras troops was good. Both sickness and mortality were less than in any of the previous six years. The chief causes of admission were intermittent fevers, abscesses and ulcers, wounds and accidents, and bowel complaints. From all these, however, the admission-rates were lower than those for the preceding year. Cholera and small-pox gave rise to a greater number of admissions than in 1882. There were in all 173 cases of cholera with 81 deaths, or a percentage of 46·82 of those treated. During the preceding year there were 116 cases with 73 deaths, or a percentage of 62·93. In 1883 there were 77 cases of small-pox against 40 in 1882, and only 4 of the 77 proved fatal.

Sickness and Mortality during the last seven years, compared.

Year.	Average Strength.	Ratio per 1,000.				Mortality, including absent Deaths.
		Admissions into Hospital.	Daily Sick.	Deaths from		
				Cholera.	All Causes.	
1877 - - -	28,304	861	28	2·79	11·80	14·36
1878 - - -	28,728	841	29	2·23	12·25	15·49
1879 - -	27,314	1,269	43	3·19	18·89	21·23
1880 - - -	28,710	1,399	54	0·10	15·57	19·54
1881 - -	28,533	997	41	1·37	12·92	16·75
1882 - - -	27,654	879	30	2·64	12·01	14·99
1883 - -	27,703	737	27	2·92	10·76	12·51

As regards sickness and mortality in the various regiments of Madras troops, the highest admission-rate occurred in the detachment of the 2nd Native Infantry at the Nicobar Islands. This small detachment of 51 men registered an admission-rate of 7,216. They suffered almost exclusively from fevers. The next highest rate, 1,752, occurred in a wing of the same regiment at Port Blair. Omitting small bodies of men, the highest admission-rates occurred in the following: the 16th Native Infantry at Raipur, 1,391 per 1,000; the 24th Native Infantry at Secunderabad, 1,099; and the Sappers and Miners at Bangalore, with detachments at Sitabaldi, Rangoon, and Cotacamund, 1,000. At Raipur, fever, anæmia, abscesses with ulcers, and injuries gave rise to the largest number of admissions. At Secunderabad the 24th Native Infantry suffered mostly from fevers, abscesses and ulcers, dysentery and diarrhœa, and venereal diseases. In the Sappers and Miners, in addition to fevers, numerous admissions took place from injuries, abscesses with ulcers, dysentery and diarrhœa, and rheumatic affections. The largest number of deaths, 29, occurred in the 9th Native Infantry at Secunderabad. Three of these deaths were due to beri-beri, and 9 to respiratory diseases; 21 deaths occurred in the 5th Native Infantry at Kamptee, 8 of which were due to cholera. In the 10th Native Infantry at Vellore, and in the 30th Native Infantry at Trichinopoly, 20 deaths occurred. In the one 18 of the total were due to cholera, and in the other 15. In the 29th Native Infantry, which was quartered during the greater part of the year at Vizagapatam, there were 31 cases of beri-beri, 5 of which proved fatal. The statistics of that portion of the Madras Army serving in Hyderabad and Nagpur were not so favourable as in 1882. Sickness was somewhat more prevalent, and the death-rate higher, viz., 18·50

against 11·58. There was a very considerable improvement in the health of the troops serving in the Northern Division of the Madras Army as compared with the preceding year. The admission-rate fell from 1,559 to 710; the daily sick from 44 to 27, and the death-rate from 13·97 to 7·93. There was an improvement also in the health of the troops in Southern India and in Burma and the Andamans.

Bombay Army.

The health of the Bombay Army was on the whole much the same as it had been in 1882. The admission and daily sick-rates were slightly less, but the death-rate somewhat higher. These results are set forth in the following table:—

Sickness and Mortality during the last seven years, compared.

Year.	Average Strength.	Ratio per 1,000.				Mortality, including absent Deaths.
		Admissions into Hospital.	Daily Sick.	Deaths from		
				Cholera.	All Causes.	
1877	23,388	1,074	33	1·93	10·90	12·96
1878	23,672	1,702	45	2·86	15·12	17·95
1879	22,854	1,663	51	3·11	20·22	21·90
1880*	15,328	1,283	45	—	10·44	56·53‡
1881*	18,349	1,166	41	1·85	14·01	25·93‡
1882†	23,772	1,067	36	0·46	12·16	13·41
1883	23,576	994	35	0·47	12·81	14·96

* Excluding Afghanistan. † Including troops in Southern Afghanistan.
‡ These ratios are calculated on the total regimental strength, including the army in Afghanistan.

Throughout the army of the Presidency there were only 21 cases of cholera, and of these 11 were fatal. Small-pox gave rise to 104 admissions against 25 in 1882. Of these, however, only two proved fatal. Bowel complaints were also more prevalent than in 1882, having equalled 70·2 against 64·0 per 1,000. The other chief diseases were less prevalent. Respiratory diseases caused the largest number of deaths—109 out of a total of 302 from all causes. Of remittent and continued fevers, 36 proved fatal against 16 in the preceding year.

Of the several portions of the Bombay Army, the force serving in Southern Afghanistan suffered most. The admission-rate in it was 1,741 per 1,000, the daily average sick 56, and the death-rate 37·64. All these ratios considerably exceed the ratios for the Bombay Army as a whole. Both the admission-rate and the daily average sick ratio of 1883 were, however, smaller than in 1882, but the death-rate was greater—37·64 against 35·80. Intermittent fevers, respiratory diseases, and bowel complaints gave rise to the largest number of admissions; the numbers admitted from the first two causes were, however, considerably less than they were during 1882. There were in all 149 deaths, 74 of them being due to respiratory diseases; 15 were due to remittent and continued fevers, against 6 in 1882. Enteric fever was entirely absent from among them. Next in order of sickness comes the Northern Division, in which the admission-rate was 956, and the daily sick-rate 33 per 1,000. Both these ratios are a little in excess of those for 1882. The death-rate, however, was small—5·47 against 7·78 in 1882. The admission-rates in the remaining three divisions of the Bombay Army were much the same; in Aden and Sind 779 per 1,000, in Konkan 774, and in Kandeish 754. Small-pox was most prevalent in Kandeish, 71 of the whole number of cases in the Bombay Army (104) having occurred there. In Aden and Sind the death-rate was 13·91 against 7·19 in 1882; in Konkan it was 9·74 against 11·17, and in Kandeish 5·33 against 6·26.

The highest admission-rate (2,241) was recorded in the Sappers and Miners at Kirki with detachments at Quetta and Aden; but the death-rate was only 10·25. High admission-rates prevailed in all the regiments serving in Southern Afghanistan. The 12th Native Infantry suffered most, with an admission-rate of 2,010 and a death-rate 67·50. Fevers and respiratory diseases contributed most largely to this mortality. Sickness was very prevalent in No. 2 Mountain Battery at Poona; the admission-rate was 1,391 per 1,000, but there was no death. Scurvy gave rise to the largest number of admissions in the Southern Afghanistan force, and especially in the 7th and 12th Native Infantry regiments; in the former 60 cases were admitted, of which 8 died; and in the latter 70 cases with 5 deaths. With regard to sickness in particular stations, it may be noted that as usual the highest proportion of admissions is recorded in the stations on the Persian Gulf, the ratio during 1883 having

been 1,846 against 1,785 in 1882. The next highest ratios occurred in Mehidpur, 1,514; Rajkot, 1,349; Dwarka, 1,345; and Surat, 1,302. At Dwarka and Mehidpur, however, there were very small detachments of 84 and 35 men, respectively. The highest death-rates were in Hyderabad, 19·23; Surat, 12·24; and Kaladgi, 12·05.

The main facts regarding the sickness and mortality in the Native Army of the three Presidencies are compared in the following table:—

Presidency.	Total Deaths per 1,000, including Absentees.	Average Strength present with Regiments.	Ratio per 1,000.			
			Admissions into Hospital.	Daily Sick.	Deaths from Cholera.	Deaths from all Causes.
Bengal Native Army - -	13·98	40,932	985	32	0·56	10·55
Madras „ „ - -	12·51	27,703	737	27	2·92	10·76
Bombay „ „ - -	14·96	23,576	994	35	0·47	12·81
Central India Regiments - -	10·16	5,197	595	19	0·39	7·89
Punjab Frontier Field Force -	23·35	16,438	1,419	45	—	21·46
Hyderabad Contingent - -	9·31	6,983	572	20	2·15	7·59
India - - - -	14·31	114,830	923	31	1·15	11·76

It will be seen that in respect of both sickness and mortality the troops of the Punjab Frontier Field Force, as has frequently happened, suffered most. Next to the Punjab Frontier Field Force the Bombay troops recorded the most unsatisfactory results. The most favourable results were yielded by the Hyderabad Contingent and the Central India and Rajputana regiments. Compared with the preceding year, the statistics of the Bombay Army were on the whole much the same; those of the Bengal Army, the Madras Army, the Central India Regiments, and the army of India as a whole, were more favourable; whilst in the Punjab Field Force and Hyderabad Contingent there was an increase in mortality.

The Aka Expedition.

Towards the close of the year a military expedition against the Akas was organised. The force was composed entirely of Native troops. It consisted in all of 30 officers, 1,028 men and 1,993 followers, and it crossed the frontier on the 17th December 1883. The object was speedily accomplished, and on the 21st January 1884 the troops began to return. By the 1st February nearly all of them were back at Tezpur. Surgeon-Major E. R. Johnson, the principal medical officer with the force, submitted a very carefully-prepared medical history of the expedition, which will be found in full in the Appendix. The report besides contains much useful information regarding the natural history of the country, and the remarks regarding the Pipsu fly and the nature of the poison used by the Akas in their arrow-heads are especially interesting. The bites of the Pipsu flies caused considerable inconvenience. The poison used on their arrows is believed to be derived from a species of monk's-hood (*Aconitum ferox*). The chief causes of admission into hospital among the troops were ague and dysentery; but the followers suffered in addition considerably from diarrhœa and respiratory diseases. Only one death from disease occurred among the soldiers, and that was from pneumonia.

Egypt Expeditionary Force.

Since the publication of the last Annual Sanitary Report, in which details regarding the health of the troops engaged in Egypt during 1882 were given, the Principal Medical Officer of the Indian Division has submitted a full report of the medical transactions of that division. As this report would doubtless interest many medical officers, it is reproduced in the Appendix.

Jails.

Sickness and mortality in jails.

Throughout India, the prisoners were, on the whole, very healthy. The admissions into hospital equalled 996 per 1,000, a considerable reduction upon the ratios of recent years, and somewhat less even than the average of the five-year period 1872–76, which preceded the famine. Compared with the results of the five years, 1877–81, which includes the famine, the reduction in 1883 has been in every respect most marked. The daily average sick-rate was 36, the lowest on record since 1877, when the statistics of all the jails in India were for the first time amalgamated. The diminished sickness as compared with the year previous is mainly attributable to the reduction in intermittent fevers; whilst in 1882 the admissions from fevers equalled 513 per 1,000, they fell in 1883 to 352. There was also a very satisfactory reduction in bowel complaints and respiratory diseases.

Statement showing the Strength, Sickness, and Mortality among the Prisoners of India during the Years 1872–76, 1877–81, *and the Years* 1880 *to* 1883.

Year.	Average Strength.	Ratio per 1,000.				
		Admissions into Hospital.	Daily Sick.	Deaths from		
				Cholera.	Dysentery and Diarrhœa.	All Causes.
1872–76 - -	99,758	1,016	?	2·86	13·48	36·24
1877–81 - -	112,670	1,189	44·9	4·48	24·97	63·01
1883 - -	88,174	996	36	2·28	10·64	31·37
1882 - -	94,063	1,214	42	2·75	15·21	39·96
1881 - -	100,844	1,214	45	3·03	16·92	44·93
1880 - -	106,768	1,213	46	0·74	19·43	48·31

The mortality from cholera was 2·28 per 1,000, a ratio but little less than that of the preceding year (2·75), but somewhat under the average for the period 1872–76 (2·86). It was, however, but one-half of the average of the years 1877–81 (4·48). Excluding cholera, the deaths from other causes equalled 29·09. The mortality due to bowel complaints fell during 1883 to 10·64 per 1,000, a smaller ratio than for any year on record since 1877. During the ten years 1872–81, the mortality under this head was 20·55.

The average strength of prisoners yielding these results was 88,174, or less by 11,584 than the average during 1872–76 before the famine-evidence not only of the complete subsidence of the disturbing influences of that calamity, but also of general prosperity among the people. Whilst in 1882 the proportion of prisoners to the general population was 4·6 per 10,000, it fell in 1883 to 4·5. The general results in relation to the population of the three Presidencies are shown in the following table :—

Ratio of Prisoners per 10,000 *of Population in each of the Three Presidencies for* 1883, 1882, 1881, 1878, *and* 1872–76, *compared.*

Presidency.	Period.	General Population according to Census of 1881.	Prisoners.		
			Average Number.	Proportion to 10,000 of Population.	Deaths per 1,000 of average Strength.
Bengal - - - -	1872–76	47,215,384	68,328	4·6	39·39
	1878		78,116	5·3	65·85
	1881		63,478	4·3	44·42
	1882		59,489	4·0	42·56
	1883		54,982	3·7	34·28
Madras - - - - -	1872–76	31,170,631	9,607	3·1	32·37
	1878		21,315	6·8	125·92
	1881		10,332	3·3	41·91
	1882		8,752	2·8	42·62
	1883		7,666	2·5	29·87
Bombay - - - -	1872–76	16,454,414	8,011	4·9	26·61
	1878		13,139	8·0	118·27
	1881		9,910	6·0	41·88
	1882		8,845	5·4	33·35
	1883		7,806	4·7	34·33

The deaths from all causes equalled 31·37 per 1,000, a ratio which is considerably less than that of 1882 (39·96), and is also lower than the average of the period 1872–76 (36·24) preceding the famine. In the succeeding five years, which include the famine period, the mortality (63·01) was more than double what it was in 1883.

As has frequently happened in former years, the statistics of the Bengal Presidency are, on the whole, unfavourable when compared with those of Madras and Bombay. In the

following table it will be observed that the ratios of the Bengal Presidency are the highest under every head, except the total mortality, and here Bombay is in excess by a fraction:—

Presidency.	Average Strength.	Ratio per 1,000.				
		Admissions into Hospital.	Daily Sick.	Deaths from		
				Cholera.	Dysentery and Diarrhœa.	All Causes.
Bengal	54,982	949	32	2·35	12·93	34·28
Madras	7,666	861	32	1·96	12·78	29·87
Bombay	7,806	734	27	2·05	6·79	34·33

Although the admission-rate for Bengal (949) is highest, it does not exceed the ratios of Madras (861) and Bombay (734) so much as in 1882. Compared with Madras, the excess is small, but it is much greater when compared with Bombay. The daily average sick-rate in the Bengal and Madras Presidencies was practically the same, 32 per 1,000; in Bombay it was only 27. In the mortality from cholera there was no great difference in the three Presidencies, for in Bengal the ratio equalled 2·35 per 1,000, in Bombay 2·05, and in Madras 1·96. The mortality from bowel complaints was much smaller in all three Presidencies than in 1882. It equalled 12·93 in Bengal, 12·78 in Madras, and 6·79 in Bombay. The most marked reduction occurred in Madras. In the Madras jails the death-rate from these diseases in 1882 had been 20·91 per 1,000; in the year under report, it was reduced to 12·78. As already mentioned, the total death-rate from all causes was greatest in Bombay, although the admission and daily sick-rates were the lowest in this Presidency. The type of sickness prevailing among the Bombay prisoners must therefore have been more severe than in the other two Presidencies. Compared with 1882, the jails of the Bengal and Madras Presidencies show a most satisfactory improvement in the death-rate, the reduction being most marked in the Madras jails, where it amounted to 12·75 per 1,000. In the Bengal jails the diminution equalled 8·28 per 1,000, which also is gratifying. The Bombay jails show an increased mortality, as compared with the preceding year, of nearly 1 per 1,000.

The marginal table shows a very satisfactory diminution in both sickness and deaths among the prisoners of the Bengal Presidency. The results for 1883, on the whole, very nearly approach those of 1877. The admission-rate, especially for 1883, namely, 949, was low, being less even than that for 1877; whilst the daily average sick-rate (32) was reduced by 8 per 1,000 as compared with the preceding year. The mortality from cholera was 2·35. This is, on the whole, a low ratio for the jails of this Presidency. The average cholera mortality for the Bengal Presidency during the years 1859–76 was 6·63; but the fluctuations in the mortality arising from this disease from year to year are so great, that an average result has little meaning. If the period 1859–76 be divided into two equal periods 1859–67 and 1868–76, it will be found that whilst in the former nine-year period the average mortality was 10·77, in the latter it was only 3·28. It is better therefore to compare the death-rate of the year under review with those of other individual years. Since 1865, the lowest mortalities recorded were 1·00 in 1880, 1·10 in 1871, and 2·35 in 1875; whilst the highest were 12·10 in 1866, 6·38 in 1879, and 6·24 in 1869. The very satisfactory decrease in the mortality from bowel complaints from 17·31 in 1882 to 12·93 in 1883 has already been noticed. The average death-rate from these diseases for the period 1859–76 was 21·83, but for the reasons just given, it will be better to compare the results of 1883 with the results of single previous years. In only three other years since 1866 was the ratio lower than it was in 1883, namely, 12·06 in 1868, 12·38 in 1875, and 10·59 in 1877. The highest ratios were recorded during very recent years, namely, 30·65 in 1879 and 28·27 in 1878.

Year.	Average Strength.	Ratio per 1,000.				
		Admissions.	Daily sick.	Deaths from		
				Cholera.	Dysentery and Diarrhœa.	All Causes.
1877–81	69,149	1,145	40	3·99	22·38	55·49
1877 "	63,690	967	30	3·07	10·59	31·88
1878 "	78,116	1,182	41	5·34	28·27	62·35
1879 "	78,801	1,285	46	6·38	30·65	77·90
1880 "	66,751	1,106	40	1·00	21·51	51·12
1881 "	63,478	1,151	41	3·10	17·91	44·42
1882 "	59,489	1,178	40	3·11	17·31	42·56
1883 "	54,982	949	32	2·35	12·93	34·28

The death-rate from all causes in the jails of the Bengal Presidency was 34·28. The average mortality in these jails for the 18 years (1859–76) was 54·24. The ratio for the year under review was among the most favourable on record, better results having been

recorded only in the years 1868 (30·28), 1875 (33·65), and 1877 (31·88). Compared with the high rates which prevailed since 1877, the reduction is most marked.

The following table shows the chief diseases which have caused admissions into hospital since the year 1873. It will be observed, that while the same order of diseases is maintained as in 1882, in every case the ratios of 1883 are lower. Compared with the average results of the ten-year period 1873–82 also, the results of 1883 are very favourable, the admission-rates in only two classes of disease having exceeded the decennial averages, namely, atrophy with anæmia and venereal diseases, and in both cases the excess in 1883 is trifling. The greatest reduction occurred in fevers, and here it equalled 99 per 1,000. Compared with the admission-rate for 1882, the total admission-rate for all the ten chief causes noted in the table was less by 213 per 1,000 and less by 133 per 1,000 than the average of the preceding ten years. A comparison of the total admission-rates from all causes in 1883 with the preceding year and with the ten-year period (1873–82) is also very favourable, showing a reduction of 229 per 1,000 as compared with 1882, and 142 as compared with the ten-year period.

Statement showing the Chief Diseases which have caused Admissions into Hospital in the Jails of Bengal Presidency from 1873 to 1883.

Number.	Diseases.	Decennial Average, 1873–82.	Admitted per 1,000 of Average Strength.									
			1883.	1882.	1881.	1880.	1879.	1878.	1877.	1876.	1875.	1874.	1873.
1	Fevers	488	389	541	528	458	660	556	371	457	398	445	450
2	Abscess and ulcer	116	102	123	127	133	114	113	122	115	99	107	110
3	Dysentery	112	100	117	105	116	129	137	98	104	96	101	110
4	Diarrhœa	103	100	108	106	117	112	107	94	86	90	96	108
5	Respiratory diseases	44	39	45	48	48	21	45	43	41	37	45	44
6	Wounds and accidents	41	36	39	40	37	36	43	48	39	43	44	43
7	Atrophy and anæmia	23	27	28	28	28	29	28	24	19	16	15	19
8	Venereal diseases	17	18	21	20	20	18	18	15	12	21	16	12
9	Rheumatism	17	16	16	15	15	15	16	21	17	16	19	17
10	Eye diseases	13	13	15	13	14	11	13	12	11	11	12	13
	Total of the Ten	973	840	1,053	1,030	986	1,166	1,076	848	901	827	900	927
	Total from all Causes	1,091	949	1,178	1,151	1,108	1,285	1,182	967	1,017	943	1,028	1,048

The reduction in the diseases which chiefly contribute to the total mortality, is equally satisfactory.

Statement showing Diseases which have been the chief Causes of Mortality amongst Prisoners of the Bengal Presidency from 1873 to 1883.

Number.	Diseases.	Decennial Average, 1873–82.	Died per 1,000 of Average Strength.									
			1883.	1882.	1881.	1880.	1879.	1878.	1877.	1876.	1875.	1874.	1873.
1	Dysentery and diarrhœa	18·90	12·93	17·31	17·91	21·51	30·65	28·27	10·69	14·75	12·38	16·38	16·63
2	Respiratory diseases	7·18	6·00	7·26	7·62	9·38	9·58	8·82	5·41	5·45	5·01	6·02	7·00
3	Fevers	5·29	2·88	3·53	4·65	4·45	13·82	7·14	1·97	2·36	4·20	3·72	5·47
4	Cholera	3·46	2·35	3·11	3·10	1·00	6·33	5·34	3·07	4·34	2·35	2·48	2·97
5	Atrophy and anæmia	3·10	2·02	3·64	2·58	3·66	5·48	5·01	2·69	2·19	1·65	2·37	1·94
6	Phthisis pulmonalis	2·50	2·31	1·98	2·24	2·53	3·00	2·76	2·35	3·24	1·86	2·51	2·33
7	Dropsy	0·80	0·80	0·88	0·68	1·05	0·99	0·88	0·71	0·73	0·67	0·85	0·55
8	Wounds and accidents	0·68	0·44	0·62	0·55	0·63	0·66	0·95	0·75	0·52	0·62	0·69	0·73
9	Apoplexy	0·66	0·60	0·30	0·58	0·88	0·76	1·02	0·80	0·59	0·52	0·31	0·81
10	Spleen diseases	0·35	0·34	0·19	0·22	0·57	0·81	0·23	0·20	0·29	0·77	0·37	0·23
	Total of the Ten	42·91	30·17	38·22	40·13	45·66	71·53	60·63	28·55	34·36	30·03	35·70	38·76
	Total from all Causes	47·36	34·28	42·56	44·42	51·12	77·90	65·35	31·88	37·51	33·65	39·90	43·08

The total death-rate from the ten chief causes of mortality was 30·17 against 38·22 in 1882 and against 42·91, the average of the last ten years. In every disease, with the exception of dropsy, the ratio of 1883 was lower than the average ratio of the ten-year period 1873–82; in the case of dropsy the ratio was equal. The most marked diminution occurred in dysentery and diarrhœa. During the preceding ten years these yielded an average of 18·90, but in 1883

the mortality due to them fell to 12·93. This result is not only satisfactory in comparison with the ten-year average, but also when compared with individual years, for it is the lowest which has been recorded since 1859, with the exception of 1875 and 1877, when it was 12·38 and 10·59. The next largest diminution occurred in fevers, the mortality from them was 2·38, less by 2·91 than the ten years' average. With the exception of the years 1876 and 1877, when the mortality was 2·36 and 1·97, the death-rate for 1883 is lower than for any year since 1865. There was also a diminution in the mortality from respiratory diseases as compared with recent years; but the reduction in them is not so marked as in bowel complaints and fevers. They caused a death-rate of 6·00 against an average of 7·18 for the ten-year period. The average death-rate of the last ten years has been raised considerably by the high ratios of recent years. Moreover, the average of the ten-year period (1863–72) was only about one-half that of the previous ten-year period; and when individual years are compared, it appears that the deaths caused by respiratory diseases in 1883 were in higher proportion than in 18 out of the 24 years since 1859.

Of the various geographical groups into which the Bengal Presidency has been divided, sickness was least prevalent in Agra and Central India and in the Gangetic Provinces with Oudh, and most prevalent in Lower Bengal and Assam. The same general result was observed in 1882. In order of unhealthiness the several groups arrange themselves as follows: Bengal with Assam, Central Provinces, Punjab, Rohilcund and Meerut, Gangetic Provinces with Oudh, and Agra with Central India. The admission-rate in Lower Bengal with Assam was nearly three times as high as it was in Agra and Central India, and more than twice as high as it was in the Gangetic Provinces with Oudh and in Rohilcund with Meerut.

Statement showing Sickness and Mortality amongst the Prisoners of the Bengal Presidency (arranged in groups in accordance with their geographical positions) from 1877–81, 1882 *and* 1883.

Groups.		Average Strength.	Ratio per 1,000.					
			Admissions into Hospital.	Daily Sick.	Deaths from			Difference between Average Mortality and year's Mortality.
					Cholera.	Dysentery and Diarrhœa.	All Causes.	
I.—Lower Bengal and Assam	1877–81	14,788	1,519	50	7·43	31·63	67·50	−14·98
	1882	13,327	1,693	54	8·25	25·44	59·95	
	1883	12,414	1,630	53	4·03	22·64	52·52	
II.—Gangetic Provinces and Oudh	1877–81	22,769	695	25	3·21	13·98	33·29	−7·53
	1882	13,515	724	28	3·19	14·36	32·70	
	1883	16,846	616	23	3·32	8·67	25·76	
III.—Central Provinces (excluding Jubbulpore and Saugor)	1877–81	3,002	983	36	11·39	26·11	69·38	+16·66
	1882	2,833	1,106	48	4·24	49·42	99·66	
	1883	2,609	1,003	41	4·22	60·56	88·54	
IV.—Agra and Central India	1877–81	5,338	1,063	49	2·89	17·16	51·33	−29·77
	1882	4,513	763	28	0·89	6·65	27·92	
	1883	4,359	556	21	2·75	6·19	21·56	
V.—Rohilcund and Meerut	1877–81	9,972	935	40	0·35	15·36	37·69	−19·33
	1882	7,187	1,007	38	—	7·65	25·46	
	1883	6,627	753	31	—	3·62	18·26	
VI.—Punjab	1877–81	14,180	1,674	51	2·38	31·64	88·13	−59·02
	1882	13,115	1,546	45	—	15·25	41·63	
	1883	12,128	951	27	—	6·18	29·11	

The daily sick-rate in Bengal and Assam was also high—53 per 1,000. Next comes the Central Provinces with 41 per 1,000, a ratio somewhat lower than that of 1882, but higher than the average of the five-year period 1877–81. Third comes Rohilcund and Meerut with 31 per 1,000, and then the Punjab with 27, the Gangetic Provinces with 23, and lastly Agra with Central India with a minimum of 21. The mortality from all causes as compared with the averages for the period 1877–81 fell in every group, with the single exception of the

Central Provinces, where the death-rate was 18·66 per 1,000 greater than the five-year average. A similarly unsatisfactory result was noted in the report for 1882. The highest mortality, 88·54 per 1,000, occurred in the Central Provinces; and next in order of high mortality come Bengal with Assam, 52·52, Punjab, 29·11, Gangetic Provinces with Oudh, 25·76, Agra and Central India, 21·56, and Rohilcund and Meerut, 18·26. In the last column of the statement given above, the differences between the death-rate for 1883 and the average mortality for the five-year period 1877–81 are given. It will be observed that the greatest reduction occurred in the Punjab, the next in Agra and Central India, Meerut and Rohilcund, Bengal and Gangetic Provinces with Oudh. It will be noticed that the death-rate in only the first and third groups exceeded the average death-rate from all causes for the whole Presidency. The mortality from cholera was much the same in the 1st, 2nd, and 3rd groups—4·03, 3·32 and 4·22. In the Agra and Central India group it was 2·75; no deaths from this disease occurred in the Rohilcund and Meerut and Punjab groups. The jails of these two groups enjoyed a similar immunity from cholera during the preceding year, 1882. Dysentery and diarrhœa caused by far the largest mortality in the Central Provinces group—60·56 per 1,000 against 49·42 in 1882, and 26·11 the average of the preceding five years. In all the other groups there was a satisfactory reduction in the death-rates from dysentery and diarrhœa.

Some improvement took place in the health of the prisoners in Lower Bengal as compared with former years. This is clearly shown in the marginal table. The admission-rate, 1,498, was less than it had been in any of the four preceding years, but was nevertheless higher than the average of the five years, 1877–81. The daily average sick ratio, 50, is also lower than that of the preceding year by 4 per 1,000, but greater than the five years average by 2 per 1,000. Sickness was thus but little less prevalent than it had been during the four preceding years, but the mortality was much less. The total death-rate was 52·21, against 69·21 in 1882 and 70·05 the average of the preceding five years. The mortality from cholera (4·27) was less than half that of the preceding year and was below the results of most previous years. The average of cholera mortality during the 18 years 1859–76 was 13·31. The comparison, however, is not quite exact, for in these years Assam was included in Bengal. A marked reduction also occurred in the death-rate from bowel complaints, which equalled 23·44. In only eight former years since 1859 was the result more favourable, in two of which, however, the difference is only nominal. The admission and death-rates from fevers (5·46 and 3·15) and bowel complaints (4·77 and 23·44) were lower than in any of the previous seven years. The average fever mortality for the period 1859–76 was 4·12.

Year.	Average Strength.	Ratio per 1,000.				
		Admissions.	Daily Sick.	Deaths from		
				Cholera.	Dysentery and Diarrhœa.	All Causes.
1877–81	17,317	1,457	48	9·34	32·94	70·05
1877	17,862	1,276	39	8·29	18·98	49·66
1878	17,718	1,291	43	11·85	31·60	70·89
1879	17,771	1,573	51	18·91	45·92	97·57
1880	17,218	1,569	53	1·60	33·74	64·64
1881	16,014	1,594	53	5·37	34·72	67·13
1882	15,330	1,642	54	9·78	32·36	69·21
1883	14,288	1,498	50	4·27	23·44	52·21

The results here given for the years 1880 and 1881 differ somewhat from those given in the same table in former Annual Reports, in which they were for Bengal and Assam combined. Those now given are for Bengal alone.

If the jails of Lower Bengal be judged by admissions into hospital, sickness prevailed most in the Khulna Jail. There the admission-rate was 3,983 per 1,000 and the daily average sick-rate 86. But the mortality from all causes was only 17·24 per 1,000. This jail was opened during the year; the number of prisoners was small, and the accommodation of a temporary nature. The next highest admission-rate occurred in the Russa Jail, 3,581. The Furreedpore Jail is the only other with an admission-rate exceeding 3,000 per 1,000. During the preceding year the admission-rate in only one jail, Moorshedabad, exceeded 3,000. Of the 47 jails of this province 3 recorded admission-rates over 3,000, 10 over 2,000, and 23 over 1,000 per 1,000. Only 3 of the 47 jails show a smaller admission-rate than 500. The highest death-rates were recorded in the Julpigoree (299·15), Ranchee (187·50), Rungpur (183·33), Bogra (115·04), Kishnaghur (107·95) and Midnapur (102·89) jails. In Julpigoree the average strength was 117, and the above death-rate was the result of 35 deaths, of which 19 were due to cholera, 10 to dysentery and diarrhœa, and 6 to respiratory diseases. In Ranchee the average strength was 160; 30 deaths took place, of which 20 were due to dysentery and diarrhœa. In Rungpur the average strength was 240 and 44 deaths occurred, of which 19 were due to dysentery and diarrhœa and 13 to phthisis. In Bogra the strength was 113 and deaths 13; 7 of these were due to dysentery and diarrhœa. In Kishnaghur the strength was 176, and the number of deaths 19; 8 of these were due to dysentery and diarrhœa. Midnapur is a large jail with an average strength of 797; 82 deaths occurred, no less than 54 of which were due to bowel complaints. No deaths took place in the Darjeeling, Noakholly, and Balasore Jails; but these are small jails, containing few prisoners. The lowest mortalities were recorded in the Bhagalpur Central Jail (12·78), Maldah (14·08), Chybassa (15·87), Khulna (17·24), Buxar (18·40), and Cuttack (19·69). Of these jails the

Bhagalpur Central Jail and the Buxar Jail are large; the former with an average strength of 1,017, the latter of 924. Nearly half the mortality of the Bhagalpur Jail was due to diseases of the lungs, whilst nearly one-half the deaths in the Buxar Jail was due to dysentery and diarrhœa. The largest number of cases of cholera occurred in Julpigoree: 23 cases with 19 deaths. In Alipur there were 17 cases with 8 deaths, in Patna 12 with 6 deaths, Buxar 13 with 2 deaths. The largest proportion of admissions for dysentery and diarrhœa took place in Khulna (1,328); Julpigoree, (1,205); Bogra (1,274); 20 other jails showed an admission-rate under this head of above 500 per 1,000; 23·44 of the total mortality, namely, 52·21, was due to these diseases.

The statistics of the jails of the North-Western Provinces and Oudh show a great improvement as compared with those of the five previous years. The admission-rate, 563 per 1,000, was considerably below that of 1882 (724). The daily average sick fell from 29 in 1882 to 23 per 1,000. The total mortality from all causes was 19·76, a ratio but little exceeding that of the year 1877 (17·54) which was the lowest recorded. Excluding cholera, the death-rate of 1883 still remains the second lowest on record. The death-rate from cholera was 2·16, a high ratio for these Provinces when compared with recent years. The average mortality from cholera during 1859–76 was 4·11, but this average was much raised by the exceptionally high rates recorded in 1860 (15·98), in 1861 (27·36), and in 1863 (9·76). The average death-rate from cholera for the nine years, 1868–76, was only 1·45. The mortality from dysentery and diarrhœa was 4·32, the lowest on record since 1859. This result was most nearly approached in former years, in 1877, when it was 4·65. The highest death-rates recorded from these diseases were 51·81 in 1859 and 44·94 in 1861.

Of the 53 jails in the North-Western Provinces and Oudh, 12 show a higher admission-rate than 1,000 per 1,000. Unao (1,195), Allahabad District Jail (1,128), Banda (1,073), Mirzapur (1,057), Bahraich (1,044), Muttra (1,112), Etah (1,250), Shahjahanpur (2,034), Budaon (1,175), Saharanpur (1,258), Almora (1,008), and Muzaffarnagar (1,412). Twenty-two others show above 500 per 1,000, leaving 19 or nearly 36 per cent. of the 53 jails with an admission-rate below 500. The highest death-rates were recorded in the following jails: Gorakhpur (146·62), Dehra Dun (127·27), Banda (64·52), Orai (60·15), Mirzapur (56·70), and Almorah (56·45). In all the others the mortality was below 50 per 1,000. In Gorakhpur, out of an average strength of 607, 89 deaths took place, of which 38 were due to cholera and 25 to dysentery and diarrhœa. At Banda, out of an average strength of 248, 16 deaths occurred, of which 7 were due to dysentery and diarrhœa. Cholera attacked only the Gorakhpur, Muttra, and Agra Jails. At Gorakhpur, where the outbreak was most severe, there were 57 cases in all, and of these 38 proved fatal; 54 of the cases took place in September, and the remaining 3 in October. In these Provinces only 4·32 of the total mortality (19·76) was due to dysentery and diarrhœa. Respiratory diseases gave rise to the highest death-rate, 4·66. They were most prevalent in Mirzapur (196 admissions per 1,000), Almora (121), Etah (97), Muzaffarnagar (87), and Orai (83).

The statistics of the Punjab jails are also very favourable. The admissions equalled 951 per 1,000, a ratio considerably smaller than that of recent years. Judged by this test, there was less sickness in only 1866 (893), 1868 (799), and 1871 (825). The daily average sick-rate was 27 per 1,000, which is also below the average since 1865. The death-rate from all causes was 29·11 per 1,000, a reduction of 12·52 upon that of the preceding year, when it equalled 41·63, and a reduction of 20·46 upon the average mortality of the last 20 years, which was 49·57. The average total mortality from all causes for the period 1859–76 was 38·98. During the last 20 years better results than these were recorded only in the years 1871 (27·19), 1868 (12·39), 1867 (24·66), and 1866 (18·32). During 1883 cholera was again entirely absent as it had been in 1882. The average death-rate for cholera during the last 20 years was 1·16 per 1,000. The mortality from bowel complaints in 1883 was 6·18, or less than half that of the preceding year or of the average of the last 20 years, which was 14·09. It was still, however, higher than it had been in several single former years since 1859,—*e.g.*, in 1865 it was 4·77; in 1866, 2·43; in 1867, 5·62; in 1868, 3·08; and in 1874, 5·88.

In the Punjab, as in the North-Western Provinces, respiratory diseases caused the greatest mortality or 9·73 per 1,000. Next came dysentery and diarrhœa with 6·18. The mortality arising from respiratory diseases continued to be higher than usual. During the years 1859–67 the average was 2·81: in the succeeding nine-year period, 1868–76, it rose to 8·00, whilst since that time, namely, 1877–82, the average has been 16·66—a large increase on former years. The highest mortality, 21·59, was recorded in 1879, but in the years preceding and succeeding that year it was nearly as high, having been 20·42 in 1878 and 20·87 in 1880. Of the 35 jails in this province, 2 recorded an admission-rate for all diseases above 2,000, namely, Abbottabad and Dera Ismail Khan. The former is a small jail with an average

strength of only 77 prisoners: the latter had an average strength of 496. Ten other jails recorded ratios above 1,000 per 1,000; in 8 it was below 500. During 1882, 8 jails recorded ratios above 2,000 and only 5 below 500. In Dera Ismail Khan the chief diseases causing admission were intermittent fevers (1,617), dysentery and diarrhœa (121), and respiratory diseases (107). The greatest mortality occurred in the following jails: Lahore Central Jail (65·99), Mooltan District Jail (47·13), Dera Ismail Khan (46·37), and Mooltan Central Jail 40·85. The Simla Jail also shows a death-rate of 50, but the strength was so small that this represents only one death during the year. In the Lahore Central Jail 123 deaths took place, 45 of which were due to dysentery and diarrhœa, 23 to respiratory diseases, and 15 to fevers. The death-rate in this jail, though again the highest among the Punjab jails, is still considerably lower than it was in 1882 (113·22). In the Mooltan District Jail 32 deaths occurred, 15 due to respiratory diseases and 9 to fevers; whilst in the Central Jail 25 deaths occurred, 18 being due to respiratory diseases, and only one to fever. The Rupar Jail was merged during the year into the Mooltan Central Jail. In Dera Ismail Khan 23 deaths occurred, 14 from respiratory diseases and 5 from dysentery and diarrhœa. Eight jails showed a higher mortality than the average of the province, namely, Ferozepore, Amritsar, Lahore Central Jail, Lahore District Jail, Mooltan Central Jail, Mooltan District Jail, and Dera Ismail Khan.

In the report for 1882 very unfavourable results in the jails of the Central Provinces were noted. Those for 1883 are but little better. The admission and daily sick-rates, 919 and 36, were somewhat less than they were in the preceding year, 966 and 41; but the death-rate from all causes was practically the same, namely, 70·97 against 71·05 in 1882. The death-rate for the last 20 years averaged 55·64, so that the mortality of 1883 exceeds this average by 15·33 per 1,000. This death-rate of 1883 has only been exceeded in six former years since 1859, namely in 1859 (72·81), 1863 (72·27), 1865 (125·77), 1866 (72·25), 1878 (118·11) and 1882 (71·05). The proportion of mortality due to cholera was practically the same as it was in 1882, namely, 2·84 against 2·91. These ratios are much below the average for the past 20 years, which is 7·31. The high total mortality was mainly due to bowel complaints, and this chiefly in the Nagpur and Raipur Jails. They contributed no less than 46·71 per 1,000 of the total. The mortality from bowel complaints is the highest since 1859, and exceeds the average of the last 20 years by 24·18 per 1,000. The mortality during 1882 was attributed to Kalahundi prisoners.

Of the 19 jails in the Central Provinces 4 record higher admission-rates than 1,000, viz., Sambalpur (1,260), Raipur (1,315), Seoni (1,458), Nagpur (1,051). In these dysentery and diarrhœa caused the largest number of admissions, excepting in the small jail at Seoni, where fevers were the most prevalent form of sickness. The highest mortality was in the Raipur (143·40), Nagpur (108·49), Sambalpur (62·99), Chhindwara (62·50), and Nimar (50·00) jails. In the Raipur and Nagpur Jails, the only large jails included in the above, the chief causes of death were dysentery and diarrhœa. In the Raipur Jail, of the 113 deaths which occurred, 87 were due to these causes; and in the Nagpur Jail 57 of the 92 deaths were due to the same. In the Sambalpur Jail 8 deaths occurred, of which 6 were due to bowel complaints. At Jubbulpore, the admission-rate was 778 and total death-rate 38·66. Cholera appeared in the Nagpur and Bhandara Jails: in the former there were 13 cases with 10 deaths, and in the latter 2 cases with 1 death.

In Berar sickness was somewhat greater than it had been in the preceding year. The admission-rate was 558 against 449 in 1882, and the daily average sick-rate 14 against 12. These results, though less favourable than those of 1882, are still very favourable when compared with years preceding 1882. The increase in sickness was almost entirely due to the greater prevalence of malarial fevers in the Amraoti Jail. The mortality from all causes was almost identical with that of the preceding year, 8·49 against 8·50 in 1882. The statistics of these jails are available since 1870, and the average mortality from that time to 1882 is 31·39. The ratio for the year under review was therefore 3½ times less than this average. The ratios of 1882 and 1883 are by far the lowest on record, the next lowest having been 15·58 during 1877. The highest ratio recorded was 75·14 in 1878. Cholera was exceptionally prevalent in that year and caused 14·64 per 1,000 of this total ratio. During 1883, as in the preceding year, no deaths occurred from cholera. The mortality due to bowel complaints was 1·89; in 1882 there was no death under this head. The average death-rate from these diseases since 1870 was 6·81. The highest ratio on record was 17·56 in 1878.

In this province there are only six jails. The highest admission-rate was recorded in the Ellichpur Jail, a small jail with an average strength of only 59 prisoners. The largest jails are those at Amraoti and Akola. The admission-rates in these were respectively 722 and 218. The highest admission-rates were due to fevers (292 per 1,000), abcesses and ulcers

(56), and dysentery and diarrhœa (44). Three of the jails recorded deaths: Ellichpur and Amraoti 2 deaths each, and Akola 5.

The results in the Burma jails were much the same as in 1882. The admission-rate continued high, 1,159 against 1,168 in 1882; the death-rate, 28·94, though slightly greater than that of 1882, was considerably less than the average since 1869 (37·75). During this period the highest death-rates were recorded in the years 1878 (57·71), 1877 (56·76), and 1869 (51·9), and the lowest in 1875 (23·5), and 1880 (24·89). Of the total mortality of 1883, 7·96 were due to cholera. This is somewhat less than the average for the years since 1869 (8·78). Considerable fluctuations occur as usual in the death-rates from cholera in these jails. In 1871 there was an entire absence of such mortality, whilst in 1878 it equalled 25·27. From bowel complaints the death-rate was 7·96, which, though a little greater than that of the preceding year, is yet below the average of past years (9·53).

Of the 12 jails in British Burma four, namely, Akyab, Rangoon, Shwegyeen, and Moulmein, record admission-rates above 1,000; in four it was below 500 per 1,000. In Akyab, Shwegyeen, and Moulmein, the rate was higher than in 1882, but in Rangoon it was less. The chief causes of admission in these jails were fevers, injuries, and dysentery and diarrhœa. The highest death-rates occurred in Kyaukpyu (169·23) and Akyab (132·77). In both these jails the mortality was greatly raised by deaths from cholera. In the former jail 115·38 per 1,000 of the total mortality was due to this cause, and in the latter 73·45. No cholera deaths occurred in any of the other jails.

Sickness and mortality were greater in the jails of Assam than in 1882. The increased sickness is attributed to increased unhealthiness generally throughout the Province. The admission-rate, 2,125, and the daily sick-rate, 56, are the highest since 1877, when Assam was separated from Lower Bengal. Judged by these rates sickness was more prevalent in the jails of Assam than in any other Province of India, the next highest admission-rates, 1,498 and 1,454, having been recorded in Bengal and the Convict Settlement, Andamans. The total mortality in Assam was 43·12 against 33·08 in 1882. The mortality from cholera was 5·80 or nearly equal to the unfavourable average of the five years 1877-81, which was 6·67. The disease was present in four of the five jails, Gauhati alone having escaped entirely. The mortality from bowel complaints (16·58) also somewhat exceeded the ratio of 1882, which was 15·38. This mortality is, however, considerably less than that of the jails of Lower Bengal, 28·44, and than the average mortality since 1877 (24·21). Since 1877 the highest mortality from bowel complaints was 34·32 in 1879. In Assam as in Bengal the prevalence of dysentery and diarrhœa contributes largely to sickness and death. Of the total admission-rate (2,125) 517 were due to these diseases.

Although the admission and daily sick-rates in the jails of Madras show greater sickness than in the three preceding years, yet the mortality was considerably less. This was mainly due to the reduction in the mortality of the Trichinopoly Central Jail. The admission-rate was 861 and the daily average sick 32 against 795 and 29 respectively in 1882. The mortality from all causes fell considerably: it was 29·87 against 42·62 in the preceding year, and 63·98 the average death-rate of the 20 preceding years. The highest death-rates recorded since 1868 were 176·01 in 1877, 126·3 in 1865, and 125·92 in 1878; the lowest, 17·9, in 1871, and 22·2 in 1872. Cholera was less prevalent than usual, and yielded a mortality of 1·96, which is considerably below the average death-rate of the past 20 years, namely, 7·78. A very great reduction in bowel complaints is also to be noticed. The deaths from this cause equalled 12·78 against 20·91 in 1882, and an average of 25·72 for the 20 previous years. The mortality from these diseases during the last 20 years has ranged between a minimum of 5·2 in 1871 and a maximum of 85·15 in 1877.

Of the 30 jails in the Madras Presidency, 11 show admission-rates above 1,000, and 6 below 500. The chief causes of admission were fevers, abscesses and ulcers, and dysentery and diarrhœa. The greatest sickness occurred in the Cuddapah (1,992) Rajamundry Central (1,716), Kurnool (1,608), and Chingleput (1,562) Jails. All these, however, with the exception of the Rajamundry Central Jail, are small jails. In the Rajamundry Central Jail fevers gave rise to 1,122 per 1,000 of the total admission-rate. The highest death-rates were recorded in the following jails: Tanjore (86·21), Bellary (74·30), and Cuddalore (73·86). In Tanjore 10 deaths took place, 8 of which were due to dysentery and diarrhœa; in Bellary 24 deaths, of which 10 were due to the same cause, 4 to respiratory diseases, and 4 to anæmia and debility. In Cuddalore there were 13 deaths, 9 due to cholera and 4 to dysentery and diarrhœa. In the Tranquebar, Madras Debtors', Nellore and Guntoor Jails, there were no deaths. In the Trichinopoly Central Jail, which, in 1882, suffered the high mortality of 164·77, a total death-rate of 55·16 was recorded, 3·56 of which was due to cholera. In this jail there were 31 deaths in all against 145 in 1882; 15 of them were due

to dysentery and diarrhœa. Cholera appeared in seven of the jails; there were in all 34 cases with 15 deaths. It was most severe in the Cuddalore Jail, where of the 21 attacked 9 died.

Among the prisoners of the Bombay Presidency there was a considerable reduction in the admission-rate. This was 734 as compared with 843 in 1882, and 1,158 the average of the five-year period, 1877–81. But the daily sick and total mortality ratios were somewhat greater than in 1882. The daily sick-rate rose from 26 in 1882 to 27, and the total mortality from 33·35 to 34·33. Although the total mortality was greater than that of the preceding year by nearly 1 per 1,000, it was yet considerably lower than the average for the 18 previous years, for which statistics are available, and which equalled 47·15. This average is made up of ratios varying from a minimum of 21·9 in 1876 to a maximum of 118·27 in 1878. The death-rates from 1877 to 1881 were exceptionally high, the average being 76·83. The average for the five years immediately preceding was 26·60. The results of the last two years are satisfactory, as showing a tendency to revert to the more favourable results of former years. Cholera prevailed more extensively in 1883 than it did in 1882, the deaths from it having equalled 2·05 in 1883 and 1·13 in 1882. Deducting these from the total of each year the result of 1883 is almost the same as that of 1882, the ratios standing 32·22 in 1882 and 32·28 in 1883. The mortality from dysentery was 6·79. This is somewhat less than it was in 1882, and about half the average for the previous 18 years, which is 13·77. This last average is made up of ratios varying from a minimum of 4·3 in 1868 to a maximum of 44·14 in 1878.

In the Bombay Presidency there are 32 jails. Of these only one, the small jail at Sawantwari, recorded an admission-rate higher than 2,000, and 7 above 1,000. Of these seven the Mhasvad Gang is the only large jail; it had an average strength of 579. The admission and daily sick-rates for this jail were 1,100 and 40. The chief causes of admission were fevers, dysentery and diarrhœa, and respiratory diseases. The next largest of the seven jails is that at Poona. The admission and daily sick-rates in this jail were 1,284 and 37, and the same diseases which gave rise to them in the Mhasvad Gang prevailed here also. In the Bombay jails, as a whole, fevers gave rise to the largest number of admissions, and next in order come dysentery and diarrhœa, abscesses, and ulcers, and respiratory diseases. Only seven jails recorded admission-rates below 500. The highest total mortality occurred in the Shikarpore Jail, 100·61 per 1,000, and this large mortality does not include any deaths from cholera. Sixty-six deaths occurred, and of these 15 were due to respiratory diseases, 13 to fevers, 8 to apoplexy, and 5 to dysentery and diarrhœa. The next highest mortality occurred in the Nara Jail, viz., 67·66, and here, too, there was no cholera. Of the 41 deaths registered in this jail, 16 were due to respiratory diseases and 14 to fevers; in five jails no deaths were recorded, and in 10 less than 25 per 1,000. Cholera attacked 9 of the jails, but in 4 of them only single cases occurred. The largest number of cases occurred in the Mhasvad Gang, namely, 11, and of these 6 died. In the Dhulia Jail 6 cases occurred with 4 deaths, and in the Yerrowda Jail, the largest in the Presidency, 5 cases with 2 deaths.

The results among the convicts in the Andamans are the most favourable on record. The admission-rate, 1,454, was considerably lower than it had been during any of the four previous years. The daily sick ratio was 67 against 80 in 1882 and 95, the average of the years 1877–81. The total death-rate, 19·63, was about one-half that of the preceding year, which was itself a favourable result as compared with the majority of the years preceding it. The death-rate from bowel complaints was notably reduced and was only 2·87. These favourable results are doubtless due, in a very large measure, to the careful observance of the measures which were noted in the Annual Report for 1882. Among the most important of these measures is gradual acclimatization and the avoidance of exposure on reclamation works during the rainy season. In connexion with this last point the Principal Medical Officer reports that "during the year (1883) in-door work all through the rainy season was "provided for as many prisoners as was found possible." A satisfactory feature in the medical history of the year was the freedom from gangrene, which formerly caused many admissions. During the year only two cases occurred. This is attributed to the careful attention paid to all cases of wounds and injuries, however trivial.

General Population.

Progress made in registration of vital statistics.

In Assam considerable progress was made in the registration of vital statistics of late years. The results are still imperfect, but the marked improvement is very satisfactory. The results in the North-Western Provinces with Oudh and Punjab also indicate that decided advance is being made. In both of them the birth and death registration extend over the whole province; in Assam the only parts excluded are some remote hill tracts. In the Central Provinces and Berar, registration has for some years been general, and the system has become established on a fair footing. On the other hand, the results obtained in Bengal and Burma are very imperfect. Registration in both provinces is restricted, and yet the records are less accurate than in other provinces where it is general. In the Madras Presidency, registration of births and deaths is not confined to selected areas; but there are still great imperfections. In Bombay also registration is general, and on the whole is fairly well performed. In the Sind Division, however, it is still backward, and the results of the Presidency as a whole are vitiated from this cause.

Analysis of vital statistics of provinces.

Excluding Mysore and Coorg, the highest birth-rate was recorded in the North-Western Provinces with Oudh and the lowest in Bengal; the rates in the Central Provinces and Berar very nearly approached the ratio of the North-Western Provinces; they were all above 40 per 1,000. The low birth-rate of 22·08 recorded in the municipalities of Bengal is evidently much below the truth. The greatest excess of male over female births was noted in the Punjab, this excess having been 15·14 per cent.; the smallest excess was recorded in Madras, where it equalled only 4·6 per cent. The highest death-rate occurred in Berar, 51·3 per 1,000, and the lowest in Burma, 14·67. The excess of male over female deaths was greatest in Bengal, where it equalled 18 per cent. In the North-Western Provinces with Oudh and in Assam the excess was nearly 16 per cent.; in Madras it was only 5·7 per cent. In all provinces the urban mortality exceeded the rural mortality. The excess was greatest in Burma, were it equalled 12·26 per 1,000; in Bengal and the North-Western Provinces with Oudh it was over 8; in the Central Provinces it was 1·08, and in Berar only 1·90.

In Bengal Proper some steps were taken with a view to securing greater accuracy in the registration of vital statistics; but the results do not show any great advance. The average birth-rate in 46 selected areas in which alone births are registered was 22·08 against 22·65 in 1882. The ratio varied from 6·40 at Darjeeling to 49·17 at Jamalpur in Monghyr. In 30 out of the 46 towns, the birth-rate was less than the death-rate. The death-rate of the province was 18·32 against 20·41 in the preceding year; but this total ratio is a mean of ratios varying from 9·93 in the Monghyr district to 36·07 in Nuddea. In only five districts did the mortality exceed 25 per 1,000. The mortality in rural circles was 18·49 and in towns 27·28. This last ratio is a mean of ratios varying from 9·56 in Sudharam to 46·97 in Gya. In all cases the mortality was less than in the preceding year, but the reduction was most marked in the case of small-pox. This is the more remarkable when taken in connexion with increased prevalence of this disease in India as a whole, as is more particularly indicated in the following section of this report. The last six months of the year were as usual the most unhealthy. Of these November and December were the worst. There was less sickness and mortality among European seamen in the port of Calcutta than in 1882. Both the admission-rate and the death-rate (excluding cholera) were lower than they had been in any year since 1879. Cholera was less fatal than in either of the two preceding years, but was still twice as severe as in 1886. The health of the Native floating population was much the same as it had been during the previous year. Cholera was the chief cause of death.

In the North-Western Provinces with Oudh, the year, owing to a light rainfall, was remarkable for the dryness of its autumn months. It was a year of plenty and cheapness of food, accompanied by improved health and prosperity of the people. The average birth-rate for the province was 40·84 per 1,000, the highest on record since 1879, when registration was commenced, and the highest in any of the provinces of India. There were great variations in the birth-rates of the various districts of which it is a mean. These variations range from 58·24 (Lalitpur) to 20·39 (Dehra Dun). In all districts, except the Terai, where exceptional disturbing influences exist, the birth-rate exceeded the death-rate. In the province as a whole, for every 100 girls, 111·81 boys were born. The total death-rate was 27·57 per 1,000, which was less than in any year since 1877. The rates in the several districts varied from 17·49 to 48·33 per 1,000. The excess of male over female deaths was on an average 15·88 per cent. The rural mortality was 27·65, and the urban mortality 35·32. The largest number of deaths occurred in May, and the smallest in October. Cholera accounted for but a small proportion of the deaths, whilst small-pox contributed an unusually large proportion of them.

Registration of births extends over the whole province of the Punjab. The total birth-rate was 39·0. This ratio is probably not much under-estimated, as it corresponds closely with the ratios of municipalities, where registration is fairly accurate. In the 49 principal towns of the province, the average birth-rate was 41 per 1,000. Of the provincial ratio, 20·87 per 1,000 represent male births, and 18·13 female; the number of boys born exceeding the number of girls by 15·14 per cent. The total death-rate of the province was 25 per 1,000 against 27 in 1882. This decrease is attributed to the healthiness of the year, but it is doubtless due also in part to imperfect registration. In the principal towns of the province the average death-rate was 30 per 1,000. Throughout the province, for every 100 female deaths there were 116·84 male deaths. The death-rate was greatest during the first two and the last two months of the year. The mortality from cholera was very small; that from small-pox was nearly double what it had been during the previous year. The mortality from fevers and bowel complaints was less than it had been in any year since 1877.

The area under registration in the Central Provinces was increased and the total population included was raised from 8,802,040 to 8,817,185. Food was abundant and cheap, and in the absence of any unusual prevalence of disease an increased birth-rate over that of the previous year might have been expected. But the total number of births registered—namely, 357,864—fell short of the number of the preceding year by 9,464. The decrease in the birth-rate extended to 11 out of 20 districts; in only four districts there was some increase, and in the remaining five the ratio was the same as in the year previous. The provincial birth-rate, which was 40·59, is a mean of district ratios varying from 34·15 to 54·29. Male births preponderated over female births by 7·61 per cent. The total death-rate was 34·56 per 1,000, a ratio almost identical with that of 1879, but greater than that of any of the intervening years. 109 males died for every 100 females. The rural mortality was 34·43 per 1,000, and the urban 35·56. All the chief diseases contributed a larger proportion of deaths than in any of the preceding years.

New rules for the registration of vital statistics in Berar were in force during the year. The total birth-rate was 40·3 per 1,000, or less by 1·7 per 1,000 than the ratio of 1882. The decrease was probably due to the greater unhealthiness of the year. Registration in some municipalities was still very backward,—*e.g.*, in Khamgaon, where the birth-rate was only 9·5 per 1,000. The birth ratios of districts were not so divergent as is generally observable in other provinces, ranging as they did from 37·8 to 43·2. Male births exceeded female births by 6·5 per cent. The total number of deaths registered was 135,081, or 57,867 more than in the previous year. The total death ratio for the province was 51·3, a mean of district ratios varying from 39·8 to 65·7. This mortality means a loss of a little over one-nineteenth part of the whole population. Mortality was heavy from all the usual chief diseases, but that from cholera (10·6 per 1,000) was specially severe. The mortuary statistics of individual districts show that although the causes which gave rise to this high death-rate operated to a great extent throughout the province, they did not operate with equal intensity everywhere, for while in Basim the mortality was nearly double, and in Ellichpur more than double that of 1883, in the Wun district the excess was only 19 per 1,000. The rural and urban mortality did not vary much: it was 51·3 in rural circles and 53·2 in towns. One hundred and seven males died for every 100 females. The highest mortality occurred in August; nearly one-half of the total deaths of the year took place in July, August, and September. The Sanitary Commissioner is of opinion that the heavy mortality of the province, and particularly that due to cholera, was influenced largely by the heavy rainfall of the year.

During the year a further reduction was made in the area under registration in British Burma. It was found that reports from certain districts were so imperfect as to vitiate the results as a whole. A revised scheme was under consideration, the adoption of which it is hoped will result in more accurate statistics. The total birth-rate for the province was 22·02. This is manifestly much below the truth; it is, moreover, a mean of variations ranging from 16·60 to 31·65. The births of boys exceeded those of girls by 6 per cent. There were great variations also in the death-rates of the several districts, which ranged from 9·22 to 21·42. The total mortality for the province was 14·67. Deaths of males greatly exceeded those of females; 127 males died for every 100 females. The death ratio for the urban population was nearly double that of the rural population—25·50 against 13·24. The latter ratio is evidently under the truth.

In Assam, registration which had hitherto been confined to the six districts of the Brahmaputra Valley, was extended during the year to the two remaining districts of the Surma Valley as well as to portions of the Khasi Hills. The population thus added embraced 4,527,934 persons out of a total of 4,881,426 in the entire province. Compulsory registration was introduced in the latter half of 1882, and was in force in all the 21 towns of the province throughout the year 1883. But, although registration in Assam has made decided

progress of late years, the results of 1883 did not indicate any further advance. The birth-rate of the province, which in 1882 was 24·83 per 1,000 fell in 1883 to 23·91. All districts, except Goalpara and Sylhet, shared in the decrease. The birth of males exceeded the birth of females by nearly 10 per cent. The total death-rate was 27·14 against 25·92 in 1882. The extremes in districts varied from 16·27 to 41·89. Deaths were most numerous in May and June. In towns the mortality was at the rate of 36·07, and in rural circles at the rate of 27·08 per 1,000. Male deaths exceeded the female deaths by 2·45 per 1,000. For every 100 female deaths, there were 116 male deaths. Cholera gave rise to a smaller mortality than in 1882, but the ratio of deaths from it was still unusually high. Small-pox gave rise to a high rate of mortality, although, as above remarked, it was lower than usual in the Province of Bengal.

The census results of 1881 have been utilised for the first time in computing the statistics of 1883 in the Madras Presidency. They show an increase of 86,370 over the total population in the preceding census. The total number of births registered was 791,774, which was more than in any year since 1869, when registration was commenced. These births yielded an annual rate of 27·7 per 1,000. In 18 of the 22 districts of the Presidency the birth ratio was between 20 and 40·9, and in only one district—Malabar—the death-rate exceeded the birth-rate. For every 100 girls born there were 104·6 boys. The total death-rate was 19·0 per 1,000 against 16·2 in both 1882 and 1881. Both these ratios are manifestly under the truth. In 11 of 22 districts the death-rate was below the average of the Presidency, and in the rest it varied from 19·4 to 38·6. With the exception of three districts, the male deaths everywhere exceeded the female deaths, the average excess for the Presidency being 5·7 per cent. In urban circles the mortality was 24·9 per 1,000, and in rural circles 18·6. The largest number of deaths occurred in December, and the smallest number in April. The death ratios from all the chief causes of death were greater than in 1882. Cholera and small-pox were unusually prevalent and fatal as compared with recent years.

During the year 501,801 births were registered in the Bombay Presidency, or a ratio of 30·50 per 1,000 of population. This is the highest ratio recorded since 1873. The district ratios show that this average was fairly maintained over the greater portion of the Presidency. In the Sind division it was still backward. In four of the five districts in this division the birth-rate varied from 15·92 to 18·81. For every 100 female births there were 109·2 male births. The total death-rate of the Presidency was 25·53 per 1,000. It varied in districts from 9·19 in Upper Sind Frontier to 41·97 in Khandeish. There were 111·06 deaths among males for every 100 deaths among females. Deaths were most numerous in June, July, and August. Compared with 1882, there was considerable increase under all the chief causes of mortality. Cholera prevailed with great severity, but the area over which it was severe was restricted. Although the deaths from cholera numbered nearly five times as many as in the year previous, the number of villages affected by it was only 3,200 out of a total of 24,431. Details regarding this and other diseases will be found in the next section.

In respect of birth registration the results in Coorg were even less satisfactory than in 1882. Special difficulties have, however, to be contended with in those remote hilly tracts. Although the year was one of good harvest and cheap food-grains, the birth-rate was estimated at only 13·43 per 1,000. The total death-rate recorded was 21·75 per 1,000 against 17·46 in the preceding year. Fevers are said to have been the chief cause of mortality, and deaths from them were most numerous during the months, January, May, and June. Cholera is said to have been totally absent.

As regards the death-rates in the Cantonments of the Bengal Presidency the smallest ratio (0·6 per 1,000) was recorded as usual in Fort William, and the highest in Cawnpore, where the death-rate was as high as 45·1 per 1,000. During 1882 also the mortality in Cawnpore was high,—namely, 40·8. Amritsar and Govindghar also recorded a high mortality, namely, 44·6 against 28·5 in 1882.

History of Chief Diseases.

Cholera.

The area over which cholera prevailed was somewhat greater than that of the preceding year, but the total number of deaths which it caused was less. From the annexed statement it will be seen that in several of the provinces the diminution was considerable, more especially in Bengal Proper, Assam, British Burma, and the North-Western Provinces, in which last the number fell from 89,372 to 18,160. On the other hand, there was a considerable increase in the Central Provinces, and a very large increase in Berar, Madras, and Bombay, in all of which the disease was severe.

Annual Deaths from Cholera in India, 1874 to 1883.

Province.	Population.	Deaths from Cholera.									
		1874.	1875.	1876.	1877.	1878.	1879.	1880.	1881.	1882.	1883.
Bengal*	66,166,696	56,376	109,998	196,590	155,895	95,192	136,363	39,543	79,189	182,852	40,439
Assam	4,485,705	16,478	6,618	8,615	11,377	6,732	17,415	2,803	5,010	21,055	14,908
North-Western Provinces and Oudh	44,107,368	6,464	44,427	48,311	33,770	22,221	55,892	21,546	25,355	99,272	18,180
Punjab	18,842,264	78	6,246	5,736	29	215	26,135	274	5,207	39	190
Central Provinces	8,802,040	14	14,643	20,124	3,418	40,985	27,575	330	9,140	11,932	16,235
Berar	2,630,018	2	22,465	2,683	842	34,306	228	1	3,404	8,573	27,897
Rajputana	‡	†	1,203	283	60	2,393	918	—	197	1,337	737
Central India	‡	†	2,555	1,929	926	8,047	2,734	299	581	1,562	1,740
Bombay	16,454,414	37	47,573	32,117	57,228	46,748	6,937	684	16,694	7,904	37,954
Hyderabad	‡	†	10,891	5,582	7,414	6,696	6	—	1,721	150	1,947
Madras	30,835,725	313	94,547	148,189	357,430	47,167	13,296	613	9,446	28,604	36,284
Mysore	5,386,138	†	2,504	12,987	2,902	723	14	25	25	993	124
Coorg	178,302	†	†	210	†	49	—	—	3	31	—
British Burma	3,663,923	960	761	3,678	7,276	6,759	1,828	2,638	5,239	7,177	2,185

* Excluding Calcutta. † Statistics not available. ‡ Population not known.

As usual, considerable variations occurred in the seasonal prevalence of cholera in the different parts of India. Whilst the period of largest mortality occurred early in Bengal and Assam, it was late in the Central Provinces and Berar. In Madras the highest mortality occurred as usual during the cold season.

Compared with the preceding year, which was, however, one of marked prevalence, Lower Bengal suffered but little. The death-rate throughout the province was 1·36 against 2·75 per 1,000 of population in 1882. The ratio of 1883 is somewhat smaller than usual, the mean death-rate during the previous five years having been 1·61 per 1,000. The disease prevailed severely in three separate parts of the province—(*a*) a more or less triangular area having as a base the 24 Pergunnahs, the Sunderbunds, Backergunge, with a portion of Midnapore, and its apex in Maldah—the largest of the three severely affected parts; (*b*) a portion at the extreme north, including the districts of Darjeeling, Julpigoree, and a portion of Rungpore; and (*c*) a part of the north-western corner of the province, including portions or the whole of the districts Mozufferpore, Durbhunga, Sarun, Shahabad, Gya, and Lohardugga. In the intermediate parts which separate these three portions, the disease was much less prevalent. Although the disease existed in every district, it confined itself to few centres of population. Only 6·55 per cent. of the villages were attacked against 8 per cent. in the preceding year. The diminished mortality compared with that of 1882 was shared in equally by the rural and urban population. The urban mortality was 3·64 and the rural 1·27, whilst in 1882 these ratios were 4·79 and 2·67. Of the 47 districts enumerated in Table I. of the Appendix to this section, 12 only recorded a higher mortality than in 1882. In some of these the excess was great; but in many of these districts which show a lower mortality than in 1882, the diminution is marked. In Calcutta the total number of deaths was 2,037 against 2,240 in 1882. In 11 districts the death-rate exceeded 2 per 1,000, varying from 2·12 in Balasore and Darjeeling to 3·65 in the suburbs of Calcutta and 4·69 in Nuddea. The mortality in several towns was very high, *e.g.*, in Daudnagar, in the Gya district, the mortality was 23·20, in Julpigoree 12·07, and in Gya 8·85. In the province, as a whole, the disease was most prevalent as usual during the dry and hot months, April to June, and subsided with the commencement of the rains. But in Rungpore during the three months of greatest prevalence (May to July), the largest amount of rain fell.

In Assam the death-rate from cholera fell to 3·29 from 4·69 in 1882. The year 1882 was, however, one of exceptional prevalence of the disease. In 1881 the ratio was 1·12, and in 1880 it was only 0·74. In 1883, as usual, every district suffered, but the following four of the eight districts of this province show an increased prevalence of the disease as compared with the preceding year: Goalpara, Darrang, Sibsagor, and Lakhimpore. The highest mortality occurred in Darrang district, the mortality having been 9·23 per 1,000 against 3·37 in 1882. No details are given of the epidemic in this district by the Civil Surgeon. The season of greatest prevalence was April to July. In January many deaths were recorded, a continuance apparently of the epidemic which occurred at the end of 1882. The urban and rural mortalities were almost identical, namely, 3·25 and 3·29 respectively. It is worthy of note that Barpeta, a town on the right bank of the river in the Kamrup district, in which the mortality equalled 23·60 in 1882, suffered to the extent of only 1·14 in 1883. In the Goal-

para district the Dhubri sub-division suffered most, and there were 40 deaths among the coolies in the Dhubri depôt.

The history of cholera among immigrant coolies to Assam presents many features of interest. The subject has been noted in several late annual reports, more especially with reference to the introduction of a pure water-supply on the river steamers and at the depôts. The new water-supply was introduced in 1879, and soon after its introduction the mortality from cholera fell so greatly as to lead to a hope that the disease would ere long be banished from among the coolies. It will be useful, therefore, to compare the cholera mortality among them year by year, for the last few years. In the marginal table the number of deaths from this disease and the ratio of deaths per 1,000 are given since 1877. The contrast between the earlier and later years is very striking, and the result most satisfactory. When the reform in the water-supply was first attended with marked diminution in cholera mortality, it was pointed out that too hasty conclusions should not be drawn from the coincidence. Since then there has been an increase in the disease, and there have been one or two severe outbreaks on board the steamers, which show that the extinction of cholera which was hoped for has not been attained. In comparing the figures, moreover, a distinction should be made between the Goalundo and Dhubri immigrants. In the earlier years the bulk of the immigrants started from Goalundo; in 1883 the great bulk started from Dhubri. In other words, the voyage for the mass of the people concerned was reduced by five days, or about one-third of the whole time. And not only has it thus been reduced by five days, but those five days involve escape from five days spent on a river within the endemic area of cholera. These two factors are very important, and should not be left out of account. Still, notwithstanding the correction to be made for them, the results, as already stated, are very satisfactory, and they are all the more gratifying because they show that under improved sanitary arrangements other diseases have diminished in even a larger proportion than cholera. In the report for 1881 it was pointed out that the prevalence or absence of cholera in a country has a most important bearing on the extent to which bodies of men passing through that country may be expected to suffer from the disease, not only during the time of transit but also for some time afterwards. But while the concurrent history of cholera over the country is an important point to be considered in connexion with the history of the disease among the immigrants, no exact correspondence is to be expected between outbreaks among the two classes as regards time. It is always difficult to determine when a moving body of men like immigrants travelling on a river steamer come under the influence of the cause which produces cholera. Moreover, even within a given area, all places do not suffer at the same time. Many towns and villages escape altogether, while of those attacked some are attacked at an early period of the epidemic and others remain unaffected till it is near its close. All these questions are of much interest, but in a practical point of view it is of great importance that attention should be fixed on the actual measures of sanitary improvement which are capable of being carried out, and the experience of the river steamers shows how much good may be done by such practical work.

Year.	Number of Deaths on the River.	Ratio per 1,000.
1877	994	23·9
1878	794	33·8
1879	196	8·2
1880	23	2·2
1881	18	1·6
1882	196	6·5
1883	138	6·6

In the North-Western Provinces and Oudh the death-rate from cholera was 0·41, the smallest on record since 1877, when the statistics for Oudh were included, and less than it was in nine of the 12 preceding years. The mean death-rate for the previous five years is 1·11. The disease was most severe in Banda, where the mortality was 5·5, and next in Hamirpur, where it was 1·4. These districts lie to the south-west of Allahabad. In Banda the disease was severe also during the preceding year. Of the 49 districts of these provinces nine remained entirely free of the disease, and only seven of them suffered with any severity. These seven are Banda and Hamirpur, already mentioned, and Mirzapore, Benares, Ghazipore, and Ballia. The urban mortality from cholera was more than twice as great as the rural mortality, namely, 0·81 against 0·39. Out of 105,421 villages, 2,536, or 2·4 per cent., recorded deaths. The highest mortality recorded in towns occurred in Muttra 4·74, Banda 5·45, and Rasra 5·43. The disease began to rise in March, culminated in July, and then gradually sank to a minimum in December.

In the Punjab cholera showed itself by only 190 deaths recorded under this head. Most of them occurred in the Delhi and Gurgaon districts, the southern corner of the province. In the Delhi district there were, in all, 72 cases, with 39 deaths. The disease was said to have been imported into the Delhi district from Gurgaon; but as the Delhi district commenced to suffer about the 17th April, and the first case in the Gurgaon district did not occur till the 11th May, by which time at least 24 of the total 39 deaths had already taken

place in the Delhi district, the explanation falls to the ground. In the Gurgaon district there were 368 cases, with 121 deaths. The type of the disease was therefore mild. The disease appeared first in the Delhi district in April, and died out during June. In the Gurgaon district it appeared first in May, reached its height in June, and died out during September. A few isolated cases occurred in several other districts.

During 1883 the mortality from cholera in the Central Provinces was 1·84 per 1,000, or about the same as the average mortality of the years since 1869. It was somewhat greater than it had been in the two previous years, but considerably less than in some years since 1869. In that year the mortality was 10·50 whilst in 1878, when the next highest ratio was recorded, it was 5·53. In these, as in other provinces, the incidence of the disease year by year is characterised by great variations. In 1883 it prevailed most severely in the Satpura and Waingunga divisions. The former division comprises six districts, and of these Burhanpur and Chhindwara suffered most, whilst Seoni, and especially Mandla, comparatively speaking, escaped. In the Burhanpur district the mortality, 9·72, was higher than in any other district of the province. In the Chhindwara district it was 7·63. In the Waingunga division there are four districts, all of which suffered more or less severely, especially the Nagpur and Wardha districts; in the former, the death-rate was 6·96, and in the latter 7·62. In the Sambalpur district, no death was recorded as due to cholera. The epidemic began in May and reached its height in August; it thereafter declined; in December no death was reported. The deaths were reported from about 5 per cent. of the total number of villages. The urban mortality was 3·95, whilst the rural mortality was only 1·64. Some towns suffered very considerably, notably Narkher, in the Nagpur district (42·49), Pandurna (32·27), and Mohgaon (33·40) in the Chhindwara district.

In the **Hyderabad Assigned Districts** cholera prevailed extensively. The total death-rate from this cause was 10·6 per 1,000, against a mean rate of 3·2 during the previous five years. This is the highest mortality on record since 1869, with the exception of 1878, when it was 15·6. The death-ratio of 1883 was, however, very nearly approached in 1875, when it was 10·2. To this mortality, males and females contributed almost equally, for whilst among males it was 10·5, it was 10·7 among females. The province includes six districts, and in every one the disease prevailed severely. It was most severe in the Ellichpur district, where the mortality was 19·0. This district is the most northerly of the districts of the province. It was next most prevalent in the Basim district, which lies to the south of the province, where the mortality was 13·3 per 1,000. The lowest death-rate was recorded in the Buldana district, the most western district, namely, 6·7. The epidemic commenced in the Basim and Amraoti districts in April, and was confined to them until June, when upon the appearance of the rains it became general throughout the province. The first case occurred on the 16th April, in a village to the extreme south of the province, and another case occurred almost at the other extremity of the province on the 24th. Between the 8th and 10th June the districts of Buldana, Ellichpur, and Akola were invaded, whilst Wun, the remaining district, was attacked on the 21st June. Out of a total number of 5,564 villages 1,838 were affected, or 33 per cent. against 9·2 per cent. in 1882. The rural and urban mortality were much the same—10·6 in rural circles and 11·4 in towns. The great prevalence of the disease is supposed by the Sanitary Commissioner to have some connexion with the unusually heavy rainfall. The rainfall amounted to 53·14 inches against 39·49 in 1882, and an average fall of 33·17 during the fifteen years 1869 to 1883. The rainfall of 1883 was the heaviest on record during these fifteen years, the next having been 48·77 in 1878, when cholera prevailed with even greater intensity; for in that year the mortality due to it amounted to 15·6 per 1,000. There can be little doubt that there is an intimate connexion between the amount of rainfall and the general health. Dry years are, as a rule, healthy, and years of heavy rainfall unhealthy; but it is difficult to connect the figures of rainfall and mortality from cholera month by month. For example, the figures show that with 13·2 inches of rain in July there were 10,567 deaths from cholera, while, with only 9·1 inches in August, there were no less than 14,531 deaths. And again, with a fall of 11·90 inches, there were only 1,160 deaths from the disease in September. The history of cholera in this province furnishes an instance of hasty conclusions regarding the importation of the disease. The Civil Surgeon of the Amraoti district records his firm conviction that the disease was introduced by a woman who had come from the Poona district in Bombay, where he believed cholera was present. She arrived in Amraoti on the 21st April. The Sanitary Commissioner of Bombay, however, states that cholera first occurred in the circle from which this woman came seven days after she had arrived in Amraoti. Of the 16 people living in the house when she was ill, not one suffered.

In **British Burma**, cholera was much less prevalent than in the previous year, the mortality having been 0·60 per 1,000 against 1·96 in 1882 and 1·42, the mean of the previous five years. Although every district returned one or more deaths, and the disease was widely

spread, the proportion of villages attacked was very small. Only 126 out of a total of 14,811 villages returned deaths, or 0·85 per cent. The Bassein, Akyab, and Thongwa districts suffered most. Of the twenty towns in the province, Akyab (4·6) and Lemyethna (4·11) alone suffered to any extent. Ten of the twenty towns were almost entirely free. The total urban mortality was 0·76, while the rural mortality amounted to 0·58 per 1,000. With regard to the seasonal prevalence of the disease during the year, the largest number of deaths occurred in January. During February and March, the disease declined; during April it increased for a short time, and at the close of the year was almost gone.

Cholera was extensively prevalent over the Madras Presidency. The aggregate number of deaths exceeded that of any year since 1878. The total mortality it caused equalled 1·2 per 1,000 against 0·8 in 1882, and 0·6, the average mortality during the previous five years. The disease was entirely absent in three districts, and in three others it prevailed but slightly. It was most severe in South Arcot, Trichinopoly, Tanjore, and Tinnevelly; in all these districts, the average mortality during the previous five years had been small. In the Ganjam and Godávari districts, on the other hand, where the average five year mortality was greatest, the disease was but little prevalent. That the disease was widely spread, is shown in the fact that of the 76 towns in which deaths are registered, all but 26 returned deaths, or in other words 65·7 per cent. In some towns the mortality recorded was great, notably in Gudiyatam (North Arcot), where it was 34·2 per 1,000, and Karur (Coimbatore), where it was 25·2. Town mortality considerably exceeded rural mortality, viz., 3·8 against 1·1. Deaths were very numerous during January (4,413), but declined up to and during May, when there were only 497. They rose considerably in June and July: subsided during the following two months, to rise again rapidly, and reach their maximum in December, when 15,164 were recorded.

In the Bombay Presidency cholera was more prevalent than usual, but the area over which it was severe was not great. Its severity was confined to the North Deccan division. Throughout the Presidency 37,954 deaths were ascribed to it, and of these no less than 30,298 were recorded in the North Deccan Division. The total death-rate from this disease throughout the Presidency was 2·31 per 1,000, against 0·48 in 1882, and 1·33, the average death-rate during the preceding 10 years. But in the North Deccan division the death-rate was nearly three times as great as the mortality for the whole Presidency, viz., 7·12—the mean death-rate during the 10 previous years in this division being 1·59. In the Sind division, comprising five districts, the disease was entirely absent, but deaths occurred in every other district except Kanara in the Konkan division. In the South Deccan division cholera was less prevalent than usual, for the death-rate was only 0·79 against 2·17, the mean ratio for the previous 10 years. In the North Deccan division, where, as already stated, the disease was very prevalent, the death-rate varied from 9·81 in the Ahmednagar district to 4·37 in the Sholapur district. Throughout the Presidency 13·09 per cent. of villages were attacked, but in the North Deccan division the percentage rose to 32·9. The disease, as usual, commenced to appear in March and reached its highest intensity in July. Thereafter it subsided quickly. Of the 17 districts in which it appeared, it is worthy of notice that in seven the first cases occurred between the 6th April and the 6th May. These districts extend from Ahmedabad in the north to Dharwar in the south, a direct distance of about 550 miles. Direct railway communication reaches only one-half this distance. Ahmednagar is a district nearly half-way between the above districts, and the dates of the first cases noted in these three districts were as follows: Ahmedabad, 7th April; Ahmednagar, 9th April; Dharwar, 2nd May. Two interesting features regarding the history of cholera in fairs are illustrated during 1883. In the Kaira district (Gujarat division) a fair is held annually in September, and as cholera began to make its appearance in July, and grew in intensity very considerably during August, fears were entertained of its outbreak at the fair, and unsuccessful endeavours were made to postpone it. The fair was held in due course, and the disease did not break out at it. The mortuary statistics of the division generally show that during September the disease was speedily declining, the number of deaths during that month having been less than one-half what it was in August, whilst in the Kaira district itself in which the fair was held the number of deaths registered fell from 230 in August to 42, or nearly one-fifth in September. An illustration of an opposite result is to be found in the history of the fair held in the Sholapur district (North Deccan division). This fair was held in July. In the division cholera commenced in March, increased rapidly during April, May, and June, and reached its greatest intensity during July, when the fair was held. The disease appeared among the people attending it with great severity. The rural mortality from cholera throughout the Presidency was 2·37, whilst it was 1·87 per 1,000 in towns.

In Mysore cholera caused but little mortality. In all 124 deaths occurred, equal to 0·03 per 1,000 of population against 0·07, the mean of the previous five years. The disease was chiefly confined to the Shimoga district in the Nagar division, where 93 deaths occurred,

87 of them during November and December. In Coorg no deaths were ascribed to this disease.

The information upon the various circumstances attending or preceding outbreaks of cholera among the free civil population is always more or less incomplete; but that furnished in the reports on outbreaks among troops and prisoners is full of important details on many points connected with the disease. From these reports a few extracts may now be made.

As regards the effects of antecedent illness, fatigue, exposure to weather, &c., the following examples occur. In three instances among British troops the first cases occurred in men suffering from other diseases. The first man attacked in Fort William had suffered from chronic rheumatism, and two days before the attack was suffering from dysentery. At Chunar, where five cases occurred in all, the first man attacked had been a patient in hospital for 39 days, suffering from inflammation of the inguinal glands. At Lucknow the first case had been admitted into hospital three days previously for febricula. As examples of antecedent fatigue the following may be cited. At Sitabuldi the first two men attacked on the 13th August had been out shooting on the 11th, when they were exposed to the sun and returned tired. They are said also to have drunk water from little wayside pools. It should, however, be noted that in the Nagpur district, in which this station lies, an outbreak of cholera commenced in May and reached its highest intensity during August. At Bellary only one case occurred, and that was in the person of a delicate man who, when seized, had been all day without food. Among native troops also in several instances the first cases appeared among men ill of various other diseases. For example, at Calcutta and Ellichpur the first men attacked were suffering from fever; at Alipore the disease occurred in a patient who was suffering from dysentery; at Lucknow in a man suffering from mumps; at Ulwar in a man under treatment for bubo, &c. Instances may also be cited among native troops of men who were attacked shortly after rejoining their regiments from leave, or from duty elsewhere. For example, the first case at Silchar occurred in a man six hours after his return from sick leave which he spent in the Punjab. In a regiment at Benares only one case occurred on the 23rd August 1883, in a man who had returned five days previously from Banda. In the Banda district cholera was extremely prevalent at that time, and also to a lesser extent in Benares itself. Similarly at Roorkee, the first man attacked came from the Naga Hills; and in three regiments at Hingoli the first cases occurred in men coming from other stations in the neighbourhood. In the three last-mentioned cases cholera was prevalent throughout that part of the country. At Mominabad, a man of the 3rd Hyderabad Contingent was attacked with cholera on the 8th June. He returned at noon from Hingoli, whither he had gone with three others, escorting a prisoner. Cholera existed in Hingoli, though not severely; but the disease was becoming active in the surrounding villages. Irregularities of diet attending the Ramzan festival are often mentioned as possible or predisposing causes of the disease. Among the Native troops one such case occurred. At Bolarum, a man of the 1st Hyderabad Contingent had fasted during the day (31st July) and eaten a heavy meal at night. Amongst the jail population also instances resembling the above might be quoted. An excellent illustration of the probable effect of mental depression as a powerfully predisposing factor may be here mentioned. A prisoner had been in the Ranchi Jail in the under-trial ward for three months and nine days, and was convicted on a charge of murder on 31st May. After conviction he was much depressed in mind and occasionally refused his food. On the 25th June he suffered from diarrhœa. On the following morning the stools became choleraic in character; vomitting set in, and in a few hours he was collapsed; suppression of urine existed for two days. On the evening of the 27th he was better, but he died on the 30th of exhaustion. No other case of cholera was known to exist in the vicinity of the jail, or in the surrounding villages; but from the Sanitary Commissioner's Annual Report it appears that cholera was commencing at that time both in the Lohardugga district in which this jail is situated, and in the neighbouring district of Hazaribagh. Diarrhœa was the prevailing disease in the jail at the time.

Of the 12 stations garrisoned by European troops in which cholera occurred, diarrhœa was said to have been absent in 5, prevalent in 3, and but little prevalent in 4. In a small body of men marching from Chakrata to Meerut among whom cholera broke out, it is said that several men suffered from diarrhœa during and after the outbreak. In a similar body of men marching from Bareilly to Naini Tal diarrhœa was but little prevalent. Amongst men marching from Secunderabad to Bangalore it was not prevalent. Amongst Native troops of 21 stations (including one camp) in which cholera appeared, diarrhœa was absent in 16 and slightly prevalent in 5. Among 31 affected jails diarrhœa was absent in 14, prevalent in 13, and slightly prevalent in 4.

In all, 18 separate bodies of European troops were attacked, and in respect of 11 of these information is given of the number of buildings occupied and the number of these

which furnished cases. They occupied 189 buildings, and in 40 of these buildings, or 21·1 per cent., the disease appeared. In the Native Army complete information is available for 21 communities. These inhabited 3,610 buildings, of which 203, or 2·3 per cent., furnished cases. Similar information for the jails of India is available in the case of 29. They comprise 544 buildings, of which 99, or 18·2 per cent., furnished cases. Regarding individual communities, great variations are found between the number of buildings occupied and the number affected. Amongst European troops the largest proportion of buildings furnishing cases occurred in Allahabad, where of 25 buildings 13 were affected, or 52·0 per cent.; the lowest proportion occurred in Secunderabad, where of 16 buildings only one furnished cases, or 6·2 per cent. Among Native troops variations in this respect ranged from 33·3 to 0·10 per cent., and among jails from 100 to 1·4 per cent.

Regarding atmospheric and telluric conditions attending outbreaks little information of any value is contributed by medical officers. In several instances the weather at the time or immediately preceding outbreaks is described as "hot and sultry," "close," "heavy," or "still." In some cases a delay in the appearance of timely rain, or a stillness of air and cloudiness portending rain but without an actual fall, or an excessive fall of rain is noted. Amongst jail reports the following may be quoted. At Muzaffarpur the conditions are thus described: "Before and during the outbreak the weather was very close and sultry. Any "wind there was blew from the east. The season has been remarkable for the excessive "rainfall, the river having overflown its banks and flooded the town and surrounding country, "to an extent seldom, if ever, seen. The rainfall up to date has been 45·08 inches "compared with 38·07 inches for the whole of the year before, and an average annual fall "of about 40 inches. The rainfall for July was 8·83 inches against 3·39 last year, and for "August 12·08 inches against 15·48 inches." At Gorakhpur the conditions as respects rainfall were very different: "In August, generally a wet month, only 4 inches and 81 cents "fell, and in September 1 inch and 48 cents. Between August 14th and September 11th "the rainfall was but 66 cents of an inch. Between September 10th and September 20th, "1 inch and 18 cents fell in slight passing showers, though the clouds were frequently heavy "and seemed to portend a heavy downpour, and after the 20th the rainfall in Gorakhpur "itself was *nil*."

No case is adduced which favours the idea that the disease was spread by contagion. The positive information regarding the experience of those who came in contact with the sick is as usual altogether opposed to this idea. The results are shown in the marginal statement, and fully confirm the statement which has been so frequently made in previous reports—that attendance on cholera cases involves no danger greater than that to which all persons residing within a cholera-affected locality and exposed to the causes which induce cholera are subject.

	Number of Cases of Cholera treated.	Number of Attendants.	Number of Attendants attacked.	Percentages of Attendants attacked.
European troops	32	256	4	1·57
Native troops	307	677	15	2·22
Jails	308	476	12	2·51
Total	697	1,409	31	2·20

As regards the important question of the relation of cholera to local sanitary defects, some few illustrations may be given. In the Gwalior fortress the medical officer states that much of the surface drainage finds its way into the tanks which supply the ablution-rooms with water. The drinking-water also from the wells was not of good quality, as it becomes contaminated with soakage from without. Among Native troops unclean tanks, overcrowded huts, and insufficient ventilation are frequently noted as sanitary defects. In Kamptee especially, overcrowding and bad water containing an excess of chlorine were complained of. Around the Julpigoree Jail dirty pools were considered to exert unhealthy influence. The medical officer at this jail also notes that "during levelling of ground inside the jail "peculiar stinking emanations used to appear from the dug-up loose earth. It was a strange "coincidence that whenever the levelling operation was being carried on, fresh occurrence "of cholera used to take place." In the Buxar Jail night-soil was buried within the jail precincts. Most of the cases of cholera occurred in the blocks close to which the night-soil was buried. In the Gorakhpur Jail the water is regarded as suspicious. Bowel complaints have for long been very prevalent. The site of the jail is very bad.

The effect of movement was on the whole very favourable. For example, at Allahabad, where an outbreak occurred among the European troops, the affected bodies were divided into 12 parties, and these were all sent into camp; in 10 parties a single move was found sufficient to arrest the disease completely; whilst in each of the remaining two parties only one additional move was found necessary. Amongst Native troops an excellent illustration of the benefit resulting from movement is to be found in the cholera-affected troops at Kamptee. In the cases of the 4th L. C. and 20th N. I., among whom there was a severe outbreak, the regiments were divided into six parties, and in only one of them

was a second move found necessary. In these two regiments, 102 cases occurred in all, only five of which occurred after movement into camp. In Ellichpur, 44 cases occurred in the 2nd H. Infantry and 2 F. Battery H. C., but unfortunately no movement into camp was made. Several instances might also be quoted among the jails, but it will suffice to mention the results obtained at Julpigoree and Gorakhpur, where the largest number of cases occurred. In Julpigoree, 24 cases occurred in all, only one of which occurred after movement. In the Gorakhpur Jail, 57 cases in all occurred, and although movement was attended with benefit, yet this was not so conspicuous as it was in the above cases. The prisoners were divided into five parties, and from the time of movement 31 cases occurred among them. One party made three movements, during which 16 cases occurred; but no further move was found to be necessary. Another party made two movements, during which one case occurred. The remaining parties found one move sufficient.

The occurrence of an isolated case of cholera at Aden is interesting. The circumstances are as follows: A sepoy of the Bombay 22nd N. I. was admitted into hospital on the morning of 31st January 1888, suffering from ordinary diarrhœa. He appears to have been suffering from diarrhœa for a day or two before admission. This regiment had arrived in Aden in December 1881, or little more than a year previously. He was a weak man, and of irregular habits. The diarrhœa continued in spite of appropriate treatment, and at about 10·30 p.m. on the following day, undoubted symptoms of cholera set in. The dejecta were of the usual rice-water appearance; he suffered from violent cramps in the legs; his body was cold and clammy; the radial pulse was imperceptible, and there was complete suppression of urine. He shortly became collapsed, and died at 5 a.m. The acute symptoms of cholera lasted therefore about six and a half hours; shortly before death the body temperature rose and continued to rise after death. No post-mortem examination was made. In connexion with this case, the medical officer of the regiment writes: "Taking all the circumstances in "connexion with this seizure, I must admit it was a very unusual case. Aden is a detached "station having very limited intercourse with India. There was no cholera or marked "diarrhœa prevalent in the town or surrounding country, and as far as I could ascertain, the "patient had not been in the company of any one who had recently arrived from a district "where cholera was prevailing. The water supply for the troops cannot be contaminated, "as it consists of condensed water, and there is no fault in its distribution. Sanitation is, "however, very defective. The natives lines are overcrowded and built on a very bad site. "There is no drainage or system of conservancy in the native town. Each house in the town "has its cess-pit, which is never emptied, owing to the porous nature of the soil. The "wells in the town are, with few exceptions, contaminated with sewage; but this cannot "affect the troops, as only ablution water is obtained from this source. The question then "arises, Could there be a mistake in the diagnosis of a case simulating cholera? Or was "this a case of cholera of spontaneous origin owing to defective sanitation? I am inclined to "take the latter view, for, if this seizure was not cholera, what disease is there with such a "train of choleraic symptoms? It could not have been a case of acute enteritis excited by "tainted animal food, as the patient took nothing but sago and rice-water while in hospital, "and the same food as his companions previous to admission. Again, it could not possibly "have been a case of poisoning by a vegetable or other irritant poison, as choleraic symptoms "would not have come on only 38½ hours after admission, but immediately, unless the poison "was administered in hospital, and there is no reason for this supposition." This is a case full of interest in many respects. From the fact of its extreme isolation, it would doubtless by many be termed a case of cholera nostras; but by whatever name the disease may be called, the train of symptoms attending it was characteristically typical of Asiatic cholera, and had the case occurred in Bombay instead of in Aden, there is little doubt that it would have been regarded as a case of true Asiatic cholera.

Small-pox.

On the whole, the year 1883 was one of great prevalence of small-pox. The total number of deaths throughout British India amounted to 232,363 against 85,131 in 1882. They were, therefore, more than 2½ times as numerous as they had been in the preceding year. This large mortality fell mainly on the North-Western Provinces and Oudh. In these provinces 138,641 deaths from this disease were recorded, or a ratio of 3·14 per 1,000 against 0·60 during the preceding year, and 1·32, the average death-rate during the previous five years. This death-rate has only once been exceeded during the past 14 years, namely, in 1878, when it was 3·9. Looking more closely into the distribution of the disease throughout these provinces, it is seen that the districts of Oudh and Rohilcund north of the Ganges suffered most. The highest mortality in any single district occurred in Bara Banki in Oudh, where it was as high as 17·53 per 1,000.

After the North-Western Provinces and Oudh, the next highest death-rate occurred in Coorg; but omitting this province and Mysore, in which registration is very imperfect, the

excess death-rate over that of the preceding year was most marked in Berar, where the mortality of 1883 (1·5) exceeded that of 1882 by 1·4 per 1,000. Next in order of excess over the ratios of the preceding year come Madras, Bombay, Assam, the Punjab, and the Central Provinces. It is worthy of notice that the rural mortality exceeded the urban mortality in Assam, North-Western Provinces, Central Provinces, Mysore, and Coorg. In the remaining provinces in which the town mortality exceeded the rural mortality the excess was most marked in Berar, the town ratio having been 5·3 against a rural ratio of 1·30. In the Punjab and Berar more than 96 per cent. of the total number of deaths occurred among children under 12 years of age. In the North-Western Provinces unfortunately the information in respect of age is not given. In Madras, 61·3 per cent. of the total deaths occurred in children under 12 years of age.

Fevers.

Fevers caused a smaller mortality than in the two previous years. The total number of deaths ascribed to them throughout India was 2,879,659, against 3,125,366 in 1882. Compared with the previous year, 6 of the 11 provinces suffered more than in 1882.

But if the ratios of 1883 be compared with the average ratios of the various provinces during the previous five years, only two, namely, Bengal and Berar, show an excess. In Bengal the mortality from fevers was 13·81 against a five-year average of 11·87, and in Berar it was 20·3 against an average of 17·5. Of the remaining provinces which show an improvement over the average mortality, the North-Western Provinces exhibited the greatest decrease. Here the death-rate was 18·82 against 26·22 during the previous five years. The Punjab also shows a satisfactory improvement, 16·25 against an average of 21·94. Taking India as a whole, December was the month during which the largest number of deaths occurred from fevers. In most provinces the highest mortality coincided with the cold season; but in Assam and Coorg the month of greatest mortality was June; in Berar, which in comparison with its population suffered more severely than any other province, it was August, and in the Central Provinces it was September.

Bowel complaints.

The total number of deaths from bowel complaints throughout India was somewhat less than in the previous year, 261,623, against 280,016 in 1882. The number in 1883 was, however, still in excess of the number in 1881, namely, 259,150. The highest ratios occurred in Berar, 7·2; Assam, 3·19; and Central Provinces, 3·02. The smallest were recorded in Madras, Coorg, Punjab, and Burma, 0·7 each. Compared with the mean ratios of the previous five years, the Central Provinces, Berar, and Bombay, only show higher ratios during 1883. The highest mortality occurred in 6 out of the 11 provinces of India during August. In Lower Bengal, Punjab, and Madras, however, the largest number of deaths occurred during the cold season.

Injuries.

The total number of deaths from injuries and accidents was 76,059 against 74,041 in 1882. The largest number of deaths occurred as usual from July to September. Compared with the aggregate number of deaths in each province during 1882, the North-Western Provinces, Punjab, Madras, and Coorg show a diminution; but the reduction in all cases was trifling. It was 160 less in the North-Western Provinces, 389 less in the Punjab, 102 less in Madras, and only 3 less in Coorg.

All other causes.

Excluding deaths from the causes above considered, there were 889,243 deaths "from all other causes" as compared with 831,361 in 1882. There was therefore again a considerable increase in the number of deaths included under this category, as there had been in 1882 when compared with 1881. The result may no doubt be attributed to improved registration generally, and to the more careful separation of all other diseases. The largest proportion of deaths ascribed to "all other causes" was recorded in Berar, Central Provinces, and Madras, and the smallest in Bengal and North-Western Provinces (omitting Coorg).

Vaccination.

The province of Lower Bengal shows the largest number of vaccinators and the largest number of persons vaccinated. The greatest energy, however, appears to have been shown by the vaccinators in the Punjab, for the average number vaccinated by each vaccinator in that province was during the year 2,274 against 1,930, the next highest number in Bombay, and 923, the smallest number in Coorg. As regards the success attending these efforts, the best results in primary cases were obtained in Bengal, where 98·89 per cent. of the operations were successful. This high standard was very nearly approached in the Punjab, Central Provinces, Berar, Madras, and Bombay, in all of which the percentage exceeded 90. The largest proportion of the population was protected in the Central Provinces. In that province

the ratio of successful vaccination per 1,000 of population was 36·37: it was next highest in Bombay, 31·01, and least in the North-Western Provinces and Oudh. But perhaps a better idea of the amount of protection which is being afforded may be obtained by comparing the number of children under one year successfully vaccinated with an estimated birth-rate of 40 per 1,000. Such a comparison shows that the largest number of infants were vaccinated in the Punjab, where the percentage of estimated births successfully vaccinated was 56·5. The percentages in Berar 53·1, Bombay 47·0, and Central Provinces 42·8, were the next highest. In Bengal it was very low, namely, 9·7, but it was even lower in British Burma, 6·0, and in Assam, 6·7. The average cost of each successful operation was greatest in British Burma, where it was seven annas and three pie, and least in Bengal, where it was only one anna and six and a half pie. Special difficulties attend vaccination in Burma, and give rise to increased expenditure.

During the year under review there was an accession of 97 paid and 127 licensed vaccinators to the Vaccination Establishment of Bengal Proper. With the increase in the establishment, the total number of operations also rose from 1,261,425 in 1882–83 to 1,361,332 in 1883–84, and the number of successful cases from 1,229,058 to 1,329,328. This increase, however, was not general throughout the Province. In the Metropolitan, Darjeeling, and Sonthal Pergunnahs Circles, the number of operations decreased greatly, as compared with the year previous. The deaths from small-pox in the Metropolitan and Darjeeling Circles were only at the rate of ·06 and ·01 per 1,000 respectively, though in the Sonthal Pergunnahs Circle the mortality from this disease was high, both in the past year and the first quarter of the current year. Of the total operations, 1,284,467 were performed by the special establishment, and 76,865 by the vaccinators attached to dispensaries. In the operations of the special establishment the percentage of success in primary cases was 98·89 and in re-vaccinations 47·69. In the dispensary operations the success was at the rate of 94·60 per cent. in primary cases, and of 56·67 in re-vaccinations. Estimating the births at 40 per 1,000, the number of infants born during the year was 1,842,739. Of these, including all operations performed either by the vaccination establishment or at the dispensaries, 178,560 were protected by vaccination, or at the rate of only 9·7 per cent. The compulsory Vaccine Act was in force in 77 places; in many of them little opposition on the part of the people was met with; and it is satisfactory to find that, on the whole, there was an increase of above 5,000 operations in these places. The result of the working of the Animal Vaccination Depôts in Calcutta are encouraging. Bovine lymph was largely experimented with, both here and in all the vaccination circles of the province, and was very favourably reported on by most of the Superintendents. Throughout the province, in all 3,458 persons were vaccinated with lymph direct from the calf, and in these the proportion of success in primary cases was 91·61 per cent.; 1,112 persons were operated on with calf lymph in tubes with a success of 80·91 per cent.; and 27,703 were vaccinated with bovine virus transmitted by arm to arm, with success at 99·88 per cent.

In the North-Western Provinces vaccination is carried on solely by the special establishment. During 1883–84 the staff was strengthened by the addition of 14 first-class and 7 second-class vaccinators. The total number of operations, nevertheless, fell from 672,463 in 1882–83 to 649,067 in the year under report. This diminution, however, was restricted to the second and third circles. In the second circle, which includes Oudh, the diminution was, perhaps, only nominal, as recent disclosures have revealed the practice of fictitious entries which swelled the numbers in several of the past years. In the third circle the decrease is attributed in some places to paucity of subjects, and in some to want of encouragement on the part of the local authorities. As in the preceding year, in the first circle, comprising the Agra and the Meerut divisions, there was not a single case of re-vaccination. The primary operations numbered 225,774, or 26,919 more than in the year previous. Of these, 216,044 were successful, or at the rate of 97·40 per cent., against 97·56 in 1882–83. In the second circle, embracing Oudh, and also Rohilcund and Kumaon, the number of successful primary operations was 128,060, or 36,377 less than in the preceding year; this yielded a ratio of success at 87·76 per cent. against 91·91 in 1882–83. In the third circle, consisting of the Allahabad, Benares, and Jhansi divisions, the successful primary operations were 221,307 (against 242,160 in 1882–83), which yielded a ratio of 89·21 per cent, against 94·19 in the year previous. In all the districts of Oudh the average number of persons vaccinated by each vaccinator was very small, varying from 165 in Gonda to 675 in Bara Banki. Of the total population, only 12·94 per 1,000, and of the total births of the year only about one-seventh, were protected.

According to recent arrangements, vaccination in the Punjab was carried on by five distinct bodies of operators, viz., the district staff the cantonment and the Native State

establishment, and the medical officials attached to dispensaries. The total number of vaccinations performed during 1883–84 by all these bodies amounted to 633,062 against 499,697 in 1882–83. Of these, 592,852 proved successful, or at the rate of 93·6 per cent. The protection thus afforded extended to a little above 3 out of every hundred people of the province. Of the total operations, 624,873 were primary cases with success in 588,761 instances, and 8,189 were re-vaccinations with success in only about half the number of cases. The percentage of success in both classes of operations respectively was 94·25 and 48·71. Out of 734,912 children born during the year, 426,253 were protected by vaccination, or at the rate of 58 per cent.

There was some diminution in the total number of persons vaccinated in the Central Provinces, as compared with the preceding year. In all, 421,542 operations were performed, less than the number of the preceding year by 12,149. Still, the total number of the year under review was higher than that of any other year, and the percentage of success was somewhat greater. Of primary vaccinations 97·19 per cent. were successful against 96·94 in the previous year, and of re-vaccinations 78·94 per cent. were recorded as successful against 77·62. Both these percentages are very high and probably over the truth, and more especially the large proportion of success in re-vaccinations. Of the total number of primary cases successfully vaccinated 42·8 per cent. were children under one year of age.

The vaccination establishment in Berar was reorganised on 1st November 1883. According to the new scheme the number of vaccinators has been tentatively reduced from 54 to 42, and it has been arranged that, instead of carrying on vaccination for only six months as heretofore, they should work for 10 months each year, and be employed for the remaining two months of the year, May and June, when the time is not favourable for vaccination, in furthering village sanitation under the direction of Civil Surgeons. Owing partly to this change and partly to the paucity of subjects, due to exceptionally high mortality among children between one and five years of age, the outturn of work during the year under review was not so satisfactory as in some of the preceding years. In 1883–84 the total number of operations, omitting those performed in Melghat, amounted to 86,322 against 110,291 in 1882–83. Out of these, 79,204 were performed by the special establishment and 7,118 by the medical subordinates attached to dispensaries. But, although there was thus a falling off in the number of operations, it is satisfactory to find that the percentage of infants protected was 70·25 to the total number of persons successfully vaccinated in 1883–84 against 61·3 in 1882–83. The percentage of success in the operations by the special establishment was 92·98 in primary cases and 34·8 in re-vaccinations; while in dispensary vaccinations the ratio of success was 89·54 per cent. in primary and 42·5 per cent. in re-vaccinations. The average number of persons vaccinated by each vaccinator was 1,887; it varied from 2,030 in Buldana to 1,790 in Akola. From March to October only animal lymph, some of which was raised locally and some received from Bombay, was used. From the end of October the work was carried on by arm-to-arm vaccination or by means of lymph preserved on points.

Notwithstanding the reduction of three officers in the vaccination staff of British Burma, the amount of work accomplished during the year was satisfactory, as compared with the preceding year. The average number of operations performed by each vaccinator was 1,163 against 835 in 1882–83. These improved results have been attributed partly to the greater facilities which now exist for obtaining lymph. The Rangoon Vaccination Depôt, established during the year, also proved useful in this respect. The number of persons vaccinated during the year rose from 55,095 in 1882–83 to 73,269, showing an increase of 18,174 over the former. Of these, 66,792 were primary and 6,477 re-vaccinations. In all, 61,901 persons were successfully vaccinated, equal to 16·70 per 1,000 of population, against 46,343 or 12·50 in the preceding year. The number of successful primary vaccinations was 57,297 against 44,704, and of re-vaccinations there were 4,604 against 1,639 in 1882–83, the percentages of success having been respectively 85·78 against 85·34, and 71·08 against 60·41 in the preceding year. There was a falling off in the work done by dispensary officials. During the previous year the number of persons vaccinated by dispensaries was 390, and in 1881–82 it was 408, but during the year under report the operations performed fell to 28, of which 17 proved successful, or an equivalent of 60·71 against 69·55 per cent. in the previous year.

The statistics of vaccination fully testify to the great zeal and energy with which the authorities have for the last few years been working in Assam. The total number of operations in the province in 1881–82 amounted to only 45,246; in the following year they rose to 57,839. In 1883–84 the number stood at 88,693, and all of them, with the exception of

570, were primary cases. In addition to these, 671 operations were performed at the Dhubri Depôt, and it is presumed that many operations in tea-gardens have escaped registration, as they were never reported. In all the districts of the province, except Darrang, a larger number of vaccinations was performed than in the year previous. The total number of primary operations in the districts was 77,787. Of these 71,068 were successful, or at the rate of 91·36 per cent. 10,336 primary vaccinations were performed in the tea-gardens. Out of these only 5,300, or slightly over one-half, proved successful. In the province as a whole the ratio of success in primary cases was at 86·66 per cent., and in re-vaccinations at 73·88. The average number of operations performed by each vaccinator was 461. The compulsory Vaccination Act was in force in the municipalities of Sylhet and Gauhati and in the Municipality and Cantonment of Dibrugarh.

In Madras the vaccination establishment in 1883 was increased by six vaccinators. The increase in the number of operations also was considerable, the total being 749,146 in 1883 against 661,256 in 1882. Of the primary operations 720,349 were performed by the special establishment with success in 669,738 cases, or at the rate of 92·9 per cent., and 12,687 were performed by the medical subordinates attached to dispensaries with success in 10,274 instances, or at the rate of 80·9 per cent. In re-vaccinations the proportion of success was 45·1 in the operations of the special establishment and 42·3 in the dispensary operations. About 46 per cent. of the operations were verified during the year by the Deputy Inspectors of Vaccination. The proportion of persons protected by vaccination during 1883 rose to 21·9 per 1,000 of population from 18·9 in 1882. In the places where vaccination was carried out 738,388 births were recorded during the year. Deducting from these the deaths among children less than a year old, the number of children available for vaccination would appear to be 625,060. Out of these only 104,017, or a little more than one-sixth, were protected by vaccination during the year; although this number exceeded the preceding year's figure by 7,973, yet the large number of unprotected children would show that much still remains to be done. Animal vaccination was carried on during part of the year in the Madras, Guntur, and Tanjore Circles, and its introduction in other circles where good human lymph is not procurable was under consideration.

During the year under review there was an addition of six vaccinators to the staff in the Bombay Presidency. The total operations amounted to 878,312 against 851,444 in 1882–83. Out of these, 845,658 were performed by the special establishment, and 32,654 by the medical subordinates attached to the dispensaries. Of the operations by the special establishment 795,056 were primary vaccinations with success in 760,290 cases, or at the rate of 95·90 per cent., and 50,602 were re-vaccinations with success in 34,099 cases, or at 67·51 per cent. Out of the dispensary operations 30,127 were primary, and 2,527 were re-vaccinations, the percentages of success in these being at 91·51 and 54·69 respectively. The number of persons successfully vaccinated per 1,000 of population was 31·01 against 30·18 in the preceding year. The compulsory Vaccination Act has been in force in the city of Bombay for the last six years, and in the town of Karachi for four year. In the city of Bombay animal lymph only was used. In Poona, Broach, Nadiad, Ankleswar, Borsad, Rajkot, and Dhrangadra both animal and human lymph were in use. In all other places vaccination was carried on from arm to arm with human lymph. The total number of heifers inoculated was 935 against 645 in the preceding year.

There was no change in the vaccination establishment of Coorg. The increase of three vaccinators sanctioned last year did not take effect until 1st April 1884. The number of persons operated on by the special establishment amounted to 4,615, or 119 less than in the preceding year. Among these the percentages of success was at the rate of 88·70 in primary cases, and at 69·70 in re-vaccinations. The operations of the medical subordinates attached to dispensaries were restricted, as in previous years, to primary cases only, but in the year under review the total number was considerably more than in 1882–83. Estimating the births of the year at 40 per 1,000, the number of infants born in the province during the year would amount to 7,132. Of these, however, only 170 were protected by vaccination.

During the year 1884 only 985 persons were vaccinated in the British Army of India; in the case of 760 the results were successful, or an equivalent of 77·1 per cent. Both the actual number vaccinated and the proportion of success attending the operations were lower than in the preceding year.

Sanitary Works—Military.

The total amount expended on all military works during 1883–84 was Rs. 67,35,325-4-10. The details, as follows, have been furnished by the Examiner of Accounts, Military Works:—

Military Works.

	Rs.	a.	p.
Original works	26,90,982	14	7
Repairs	20,76,471	15	2
Establishment	13,60,112	5	2
Tools and plant	49,963	11	9
Barrack department	5,57,794	6	2
Total	67,35,325	4	10

The works of chief importance and magnitude that have been in hand were these—

Accommodation for Troops.—At Lucknow the substitution of permanent for temporary barracks for two battalions of British infantry has been in virgorous progress and is nearly finished. At Darjeeling new cantonments have been started to accommodate a mountain battery, a wing of British infantry, and a convalescent depot. At Peshawar the restoration of accommodation for the British garrison has been started and is in vigorous progress. This lies in the renewal or improvement of the old barracks so as to convert them into permanent barracks. (The outlay involved in this case is shown under the sub-head "Renewals and Improvements.") At Quetta a new cantonment to accommodate a battalion of British infantry has been in vigorous progress, and have been more than half carried out. Barracks, so arranged as to form a defensible position, has been built for the Native garrison at the North-East Frontier station of Buxa. At Peshin, the advanced position in Biluchistan, a defensible post has been nearly finished, with complete accommodation for half a battalion of Native infantry and a detachment of cavalry, the accommodation including provision for officers' quarters, hospitals, commissariat, transport, and all other accessories to make the position completely self-contained and independent. At Cherat, on the hills in rear of Peshawar, but accommodation is to be provided for a battalion of British infantry. The work has as yet not gone further than the preparation of designs. Designs and preliminaries have been under preparation for two posts at Sharigh and Dukki in Biluchistan similar to that at Peshin.

Accommodation for Officers.—Quarters have been in progress at Quetta and in the defensible post at Peshin.

Hospitals.—A large hospital for the Native garrison of Rawalpindi has been built. The conversion of existing buildings into station hospitals has been in progress at Rawalpindi, Morar, and Agra.

Prisons and other cognate disciplinary wants.—Military prisons have been finished at Dagshai, Sialkot, and Peshawar, and cells for prisoners have been finished at Kasauli and Murree, and have been in progress at Sialkot and Peshawar. Gymnasia have been erected at Delhi and the Murree gullies, and one has been in progress at Roorkee.

Renewals and Improvements.—The substitution of tiled for combustible roofing has been extensively carried out at Meerut, Delhi, Roorkee, Agra, Muttra, and Bareilly (as well as elsewhere); ceilings have been supplied to the barracks and in part to the officers' quarters at Nowshera; and improved flooring has been under supply to barracks and hospitals at Meerut Roorkee, and Umballa.

Commissariat Department.—Buildings for its general requirements have been in progress at depôts on the Bolan Road, at Rindli, and Bibinani. Bakery requirements have been completed at Roorkee, and are in progress at Landour, Bareilly, Shahjahanpur, and Rawalpindi. Steam flour-mills have been erected at Umballa and Rawalpindi. Slaughter-houses have been built at Saugor, Bhagsu, Mooltan, and Rawalpindi; and quarters for subordinates have been completed at Jubbulpore and Rawalpindi.

Military Roads.—There was only one great work in progress, but that is of special importance, viz., the Bolan high-level road from the terminus of the railway at the mouth of the pass along the Bolan valley and across the great *dasht* or plain to Quetta. Its length is 86 miles. The work consists of three parts—(*a*) the formation of the road; (*b*) its metalling; (*c*) its large bridges. (*a*) The formation, which includes the whole work except (*b*) and (*c*), was completed, except at two points; and at these and at all gaps for bridges temporary expedients had been devised for the passage of traffic; (*b*) metalling had been laid only at such parts where the road could not have borne the traffic even temporarily without it; and (*c*) no large bridges had been erected except two, where the road was impassable without them.

General Cantonment Works.—These embrace three classes of works,—(*a*) water-supply; (*b*) drainage and protective works; and (*c*) cantonment roads.

Under (*a*) *Water-supply*—

(i.) The supply to Peshawar has been completed and distributed, it is now under contemplation to extend it to the bazar;

(ii.) The extension of the Umballa water-supply was in progress;

(iii.) A *karez* for the supply of the post at Peshin had been constructed;

(iv.) The supply of Chakrata had been begun and the pipes ordered.

Under (*b*) *Drainage and Protective Works*—

(i.) The works sanctioned for Naini Tal had been carried out;

(ii.) The drainage of Quetta was in progress.

And under (*c*) *Cantonment Roads*—

The roads of Quetta were in progress.

Civil Sanitary Works.

Very little appears to have been done during the year to improve the sanitary condition of villages in Bengal. In the municipalities 34 per cent. of the total income was spent on sanitary works, or in actual numbers Rs. 17,54,096. Of this, however, Rs. 1,69,339 were expended for the treatment of the sick, and Rs. 16,533 on markets and slaughter-houses. Omitting these, the different items of expenditure were as follows:—

	Rs.
Conservancy	6,33,811
Drainage	96,097
Water-supply	1,60,449
Disposal of the dead	10,992
Construction, maintenance, and repair of roads	6,06,120
Other sanitary works	53,680
Total	Rs. 15,60,589

Of the amount for water-supply all but Rs. 36,769 was spent on the water-works in progress in Burdwan, on the extension of the Darjeeling water-supply to Kurseong, and on some repairs in the water-works at Dacca. Drainage schemes were inaugurated and in most cases taken in hand in Serampore, Ghattal, Berhampore, Lalbagh, Azimgunge, Dinagepore, Chittagong, and English Bazar in Maldah. In Nuddea, Dinagepore, and Moorshedabad, obstructions to drainage were removed, and some progress was also made in the Cuttack drainage scheme. Measures were being taken to extend the Calcutta water-supply to the suburbs of the town; and a project for supplying filtered water to the riverside municipalities from Howrah to Serampore has been under the consideration of the Local Government.

No sanitary works of any importance were accomplished in the villages of the North-Western Provinces and Oudh, but in many of the chief towns of these provinces much was done during the year under review to better their sanitary condition by improving the roads, drainage, sources of water-supply, conservancy arrangements, and in constructing wells, tanks, latrines, &c.

Of the sanitary works executed or undertaken in the Punjab during the year the following were the most important. Plans in connection with the water-supply and drainage of the city of Amritsar were in hand, those relating to the water-supply project being well advanced. The deep irregular ditch round the city of Amritsar was being filled up by the municipality, and when completed the land thus gained will be turned into gardens. Plans and levels for the drainage of Sialkot city have been prepared and submitted to Government for orders. At Simla the construction of the Sanjouli reservoir in connection with the water-works was being rapidly pushed on. A project was also under consideration for replacing by oval-shaped cast-iron drains the present objectionable V-shaped wooden drains which now carry off the drainage of the bazar into Combermere ravine, and a system of sewage pipes was also in hand to ensure a better and more effectual disposal of the sewage. At Georgegarh in Rohtak, where the water-supply was very deficient, a large masonry tank was nearly completed during the year. At Deoband in the Derajat division a covered drinking-water tank was constructed, masonry drains for water-supply were built at the Tank tahsil, and a scheme for improving the drainage of Banduwali outpost was in hand. In the Rawalpindi division drinking-water tanks were built on the Murree and Abottabad road. Compared with the three preceding years the municipalities showed on the whole greater activity in

attending to their sanitary wants. Out of a total income of Rs. 41,00,474, Rs. 12,41,831, or nearly one-third, were spent on sanitary works.

In the Central Provinces the only important civil sanitary works were the completion of the water-works at Jubbulpore and Hinganghat. In almost all the districts sanitary improvements of minor importance were carried out, such as the sinking of new wells, cleansing and repairing of tanks and wells, constructing road-side drains, filling up excavations, &c. Conservancy arrangements were also well attended to in all the municipalities in the province.

Of the sanitary works executed or undertaken in Berar during the year, the following were the most important: The *Kalapani* tank, which is intended to supply the town of Amraoti with water by means of pipes at an estimated cost of Rs. 3,02,646, was in progress. The *Wadali* tank, from which water is supplied both for cattle and drinking purposes at the station of Amraoti, was completed at a cost of Rs. 10,890. Works in connection with the *Hergowan* tank in the Amraoti district at an estimated cost of Rs. 19,775 were in progress. It is intended for cattle sent to the grazing tracts during the hot season. In Ellichpur the works in connection with the *Dhamangaon* tank, which is intended for cattle and is estimated to cost Rs. 14,144, were well advanced by the end of the year. In Melghat, weirs were being constructed at an estimated costs of upwards of 25,000 rupees. In Akola the *Janona* tank was under construction, and Rs. 25,853 were expended on it during the year. Altogether, Rs. 1,69,435 were allotted during the year to sanitary improvements. But out of it Rs. 1,56,878 only were expended. Compared with 1882, more money was spent on sanitary improvements in all the places, excepting the villages. The attention of all district officers, however, has again been called "to the necessity of carrying out the rules laid down in the "village sanitary code, and of preventing, as far as possible, the accumulation of filth inside "the boundaries instead of at suitable places on the outskirts of each village."

The work of sanitary improvement in Assam was restricted to towns and municipalities. The most important items were the completion of the water-works at Shillong and of the drainage-works of Goalpara, which have effected considerable improvement in the sanitary condition of that once water-logged town. Works in connection with the Gauhati water-supply also were in progress. They are estimated to cost Rs. 40,000. In the other municipalities, no special work was carried out; but in them much more was spent than in 1882 on street sweeping, cleaning of drains, and construction of roads and culverts. It was proposed that instructions should be issued to all district engineers to draw out plans for providing water to all the towns on the same system as has been devised for Gauhati.

In British Burma no special sanitary works of importance were undertaken during the year, except the scheme for supplying the town of Prome with river water. In almost all the principal towns many minor improvements and repairs, such as cleaning wells, constructing public latrines and drains, filling cess-pits, &c., were effected, and everywhere great attention was paid to conservancy arrangements. The total sum spent on these improvements during the year was Rs. 1,99,959. This is made up of Rs. 1,12,003 spent on markets; Rs. 67,920 on water-works; Rs. 10,412 on burial grounds; Rs. 6,637 on latrines; and Rs. 2,987 on drainage.

In the municipalities of Madras the amount allotted for sanitary purposes during the year under review was Rs. 12,02,870. Of this Rs. 6,31,611 were for the city of Madras alone, and the remainder, Rs. 5,71,199, for all the other municipal towns in the Presidency taken together. In these no work of any magnitude seems to have been executed. All that was done consisted mainly in the repairing and cleansing of tanks and wells, latrines, drains, dust-bins, markets, and slaughter-houses; in the construction of latrines, drains, and dust-bins; in the sinking of a few wells, and in some other minor works. In the fund circles Rs. 3,99,672 were sanctioned for sanitary purposes. Of this Rs. 1,63,006 were for conservancy, Rs. 40,030 for improvement of village sites, Rs. 84,581 for improvement of water-supply, Rs. 10,971 for sanitary arrangements of fairs, Rs. 58,068 for construction and repair of markets and slaughter-houses, and Rs. 43,016 for other sanitary objects. The works executed were mostly of the same nature as in the municipalities.

In the municipalities of the Bombay Presidency, out of a total income of 27 lakhs, nearly 11½ lakhs were expended on conservancy arrangements. In the Surat municipality measures were being devised for a thorough drainage of the city by means of underground drains; the public park was extended at a cost of Rs. 9,324; Rs. 2,109 were spent on new latrines and Rs. 18,566 on roads. At Ahmedabad Rs. 4,226 were spent in constructing new drains and repairing old ones, and an outlay of Rs. 1,75,744 was incurred on account of new roads and repairs to old ones. At Dakor Rs. 12,000 were spent on an embankment for a tank. At Broach some slopes were improved at a cost of Rs. 8,150. At Sholapur a branch sewer

of stone masonry, 330 feet long, and an open drain, 500 feet long, to carry off waste water into an underground sewer, were constructed during the year, and Rs. 5,819 were expended in erecting water stand-posts. At Ahmednagar Rs. 3,779 were expended on water-works, and Rs. 2,583 on drains and gutters. At Bhingar a tank was constructed at a cost of Rs. 1,000, and at Yeola six new latrines were built at Rs. 1,148. At Poona Rs. 7,362 were spent on roads, Rs. 2,089 on latrines and urinals, Rs. 7,965 on markets, Rs. 7,994 on water-works, Rs. 1,316 on the night-soil depôt, Rs. 3,476 on U-shaped drains, and Rs. 5,269 on cremation ghats. At Kurrachee Rs. 35,426 were expended on re-metalling roads. In the local fund circles nearly 2¾ lakhs of rupees were expended on sanitary improvements. Of these the following were comparatively important: In Ahmedabad Collectorate Rs. 11,004 were expended in constructing new wells and tanks and repairing old ones. In Kaira Rs. 16,765 were spent on 11 new wells and ten tanks. In Panch Mehals Rs. 3,895 in constructing new wells and tanks and repairing old ones. In Surat Rs. 23,776 on tanks, wells, and troughs. In Thana and Kolaba Rs. 13,344 and Rs. 5,504, respectively, on tanks and wells. In Ahmednagar and Nasik Rs. 14,117 and Rs. 7,883 were spent on new wells and improving old ones. In Belgaum Rs. 16,542 were expended on sanitary works, and in Dharwar Rs. 1,06,254 in repairing and improving tanks.

Of sanitary improvements in Coorg there is little to record. The Public Works Department spent only Rs. 140 in sinking a new well and repairing roads and old wells. In the Mercara municipality the conservancy establishment was maintained at a cost of Rs. 2,906. But for want of funds very little was done to improve the drainage of the town and to carry out the scheme for the water-supply which has been under consideration for some time. At Viranjendrapet Rs. 1,187 were expended on repairing roads, making drains, and other minor improvements, Rs. 2,196 on conservancy, and Rs. 1,050 in constructing a slaughter-house and a fish market.

General Remarks.

German cholera Commission.

Under the head of "General Remarks" the most important facts to be noted are the visits to India of two special Commissions, which came for the express purpose of inquiring into the cause of cholera. The first of these was the German Commission, which consisted of Messrs. Koch, Gaffky, and Fischer. After a few weeks in Egypt, where they had been engaged in similar investigations, they arrived in Calcutta on the 12th December 1883, and continued their work till the end of March 1884. They were provided with such laboratory and other accommodation as the Medical College could afford, and every endeavour was made by the College and other authorities to render them assistance. As the result of their labours they announced that the bacillus which they had first met with in Egypt, is an organism peculiar to cholera—that it is never absent in cases of cholera, and that it is never present in other diseases. They accordingly called it the "Cholera Bacillus," or from its peculiar curved shape the "Comma Bacillus." Their experiments led them to believe that this bacillus was destroyed in an acid medium, and this in their opinion explained why it proved inert when taken into the stomach of an healthy man or other animal. The bacillus was freely cultivated in gelatine and other media, but all endeavours to produce cholera by feeding animals with it or by inoculating them with it proved altogether unsuccessful. Notwithstanding these failures, the German Commission held that the comma bacillus was undoubtedly the cause of cholera. Shortly before they left Calcutta, they found this bacillus in a tank around which a few cases of cholera had recently occurred, and this was regarded as positive proof, not only that the bacillus is the cause of cholera, but also that it is distributed mainly through the medium of the drinking-water. No collected record has yet appeared of the labours of the German Commission. The account of their work both in India and Egypt is scattered over several official reports, and further information may be found in the address which Dr. Koch delivered before the Medical Conference held at Berlin on the 26th July 1884. Extracts from these reports and from Dr. Koch's address and a more detailed discussion of them will be found in the separate paper entitled "Cholera: what can the State do to prevent it?"

English cholera Commission.

The statements made by the German Commission were readily accepted on Dr. Koch's authority, and it was believed by many that the cholera problem which had so long puzzled mankind had at last been solved. They were not only of great scientific interest, but also of great practical importance. It was felt that their accuracy must be tested, and that they must either be verified or set aside. A separate Commission was accordingly despatched from London to examine the question afresh. The Commission consisted of Dr. E. Klein and Dr. Heneage Gibbes. They arrived in Bombay in the beginning of September, and

after a few weeks in that city they came to Calcutta and carried on their investigations in the same laboratory which had been used by the German Commission. They left India again early in December 1884. A full account of their work is now being printed in London.

In the investigations of both Cholera Commissions the want of a properly fitted laboratory, suited for work of this kind, was much felt. Arrangements are now in progress for providing a suitable building with all the other requisites. Dr. D. D. Cunningham, who was engaged for so many years in the cholera inquiry along with Dr. T. R. Lewis, has been again associated with the Sanitary Department of the Government of India, and will remain in charge of this laboratory.

ABSTRACT OF REPORT OF THE SANITARY COMMISSIONER FOR MADRAS FOR 1883.

(*Dr. M. C. Furnell.*)

European Troops.

Sickness and mortality among European troops.

The strength of Her Majesty's European troops during 1883 was 13,458. The total admissions into hospital amounted only to 991·0, which is the smallest number of any year on record since 1860. The deaths amounted to 10·0 per 1,000 only, which also is the lowest figure on record except 1880.

In the annexed table will be found the ratio per 1,000 of admissions, daily sick, mortality, and invaliding since the year 1870.

Years.	Ratio per 1,000 of Strength.			Invalided.	
	Admitted.	Daily Sick.	Died in and out of Hospital.	Change of Climate.	For Discharge.
1870 - -	1,481·5	63·2	19·7	76·4	6·6
1871 - -	1,211·5	56·2	19·1	29·7	12·5
1872 - -	1,352·3	59·7	19·2	26·8	11·2
1873 - -	1,270·8	59·3	18·5	50·6	12·7
1874 - -	1,141·2	57·6	13·4	29·5	8·3
1875 - -	1,096·3	56·9	14·8	60·3	15·5
1876 - -	1,132·9	55·2	16·1	31·9	10·9
1877 - -	1,172·2	58·2	17·2	36·0	10·2
1878 - -	1,379·7	65·0	22·1	36·6	9·1
1879 - -	1,438·7	68·4	16·8	34·8	10·2
1880 - -	1,385·4	68·4	9·9	15·0	8·0
1881 - -	1,164·8	68·2	11·1	18·6	8·8
1882 - -	1,069·4	59·8	10·4	17·6	12·0
1883 - -	991·0	59·7	10·0	20·1	13·6

There were 19 cases of cholera, 10 of which proved fatal. Eight of the 19 cases occurred in Kamptee with 3 deaths only. Five cases occurred at Secunderabad, all of which proved fatal. Considering that cholera has been very prevalent and fatal amongst the general population during 1883, Her Majesty's troops may be considered to have escaped wonderfully well.

There was 9 admissions in all under small-pox, with 1 death, which occurred at Secunderabad.

There were 1,385 admissions under all heads of fever, with 31 deaths. The admissions are fewer in number than either last year or the year before, but the deaths are more numerous. In 1882 we had 1,928 admissions with 26 deaths; in 1881, 2,880 admissions and 7 deaths only. Under typhoid fever there were 94 admissions with 29 deaths, or 30·8 per cent. of deaths to admissions. This is a larger number of typhoid cases than during the preceding two years, but the deaths are proportionally not quite so numerous as last year. Bangalore as usual had the greatest number of cases, 41 with 11 deaths; Secunderabad came next with 28 cases and 7 deaths. Continued and remittent fevers were answerable for 291 out of 1,385 admissions under fever, but with only 2 deaths, all under remittent fever. The greatest number of remittent (74) was at Secunderabad; the largest number (54) of continued fever occurred at Rangoon. As usual by far the largest entry was under intermittent fever; but no mortality.

There were 969 admissions under dysentry and diarrhœa; 513 cases of dysentery and 456 of diarrhœa, with only 3 deaths in all from dysentery. Considering what a heavy source of mortality dysentery was in former, say 20, years ago, these figures are very remarkable. Last year it was noticed that with 967 admissions there were only 6 deaths, and this year the report is even more favourable.

Diseases of liver were answerable for 422 admissions and 17 deaths. Bangalore had no less than 83 cases, but 1 death only; Rangoon 78 cases with 4 deaths.

There were not quite so many cases of venereal disease this year as last, but still the entries under this head were high, viz., 2,581, being a ratio of 243·2 per 1,000 strength.

Native Troops.

Sickness and mortality among Native troops.

The strength of the Madras Native Army on the 1st January 1883 was 28,160; during the year this figure was increased by recruiting and other causes to 30,968; there was a decrease by invaliding, discharge, and other causes of 1,787, leaving a total on 1st January 1884 of 29,181.

This office received returns from 24,998 troops only. The remaining 4,183 were serving beyond the limit of the Madras Command. Of this number (24,998), 17,347 were admitted into hospital, the average daily sick being 694·71. There were 310 deaths—240 in hospital and 70 out. This gives us a death-ratio per 1,000 of 12·4 to strength, which compares favourably with 1882, when the death-rate was 15 per 1,000.

The annexed table shows in a condensed form the admissions and deaths amongst the Native troops since 1868. It will be seen that 1883 compares favourably not only with its immediate predecessors, 1882 and 1881, but with any year until we reach back to 1871.

	Ratio per 1,000 of Strength.														
	1868.	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	1880.	1881.	1882.	1883.
Admissions -	707·4	702·5	630·6	603·9	1,067·9	883·2	772·7	777·7	726·2	832·2	705·2	1,001·2	1,275·9	948·7	866·0	693·9
Daily sick -	29·0	29·3	26·4	26·9	34·7	31·3	30·9	30·7	28·2	28·8	29·7	40·4	55·8	44·6	36·2	27·7
Deaths in hospital -	8·6	10·1	9·4	8·8	9·9	6·4	7·7	9·0	9·8	11·3	11·7	11·8	12·3	13·2	12·6	9·6
Deaths out of hospital -	1·4	3·6	2·6	1·8	2·4	1·8	2·0	1·5	1·2	1·7	1·6	2·4	2·4	3·0	2·6	2·8
Invaliding -	16·4	24·5	25·6	25·3	28·4	30·8	33·2	32·3	37·1	36·5	52·6	38·0	31·8	42·0	29·0	26·9

The principal causes of admissions into hospital were—fevers of all sorts 6,469, skin diseases 2,521, violence and accidents 1,570, and diseases of the bowels (dysentery and diarrhœa) 1,076, diseases of the heart and lungs 706.

The largest number of deaths was this year as last, entered under cholera. There occurred 136 cases altogether with 47 deaths. Kamptee, Vellore and Trichinopoly were the stations which returned the greatest number of cases and deaths. Two of these stations—Vellore and Trichinopoly—have a notoriously foul water-supply.

There were 31 deaths amongst the 6,469 admissions under fever—1 under febricula, 2 from continued fever, 15 from intermittent, and 13 from remittent fever. Unlike his European fellow-soldier, the sepoy seems to enjoy an immunity from typhoid fever; but, on the other hand, he succumbs to intermittent fever, which is seldom or never fatal to the European.

There were 63 admissions under small-pox—38 in Secunderabad alone—with only 3 deaths. This is a larger number of small-pox cases than usual, but the deaths remain much the same. Considering how prevalent the disease was during the year amongst the civil population, these numbers show that the Native Army was well protected.

Jails.

Sickness and mortality in jails.

According to the medical returns the average strength of all jails during the year under review was 7,699, the total admissions were 6,662, and the daily average sick 247·64. There died during the year 227 prisoners, being a death-rate of 3·4 per cent. on admissions, which is a considerably less death-rate than the last 10 years.

Out of a total of 6,662 admissions into hospital, no less than 1,998, or nearly one-third, were from fevers; 253 continued fevers, but of what form is not specified; there were no typhoid cases. The greater number (1,726) were under the head of intermittent. The largest number was, as usual, in the Rajahmundry central jail, viz., 845. It is a large, clean new jail, with 753 inmates; but from a recent inspection I am inclined to think this large number of intermittent fever cases arises from insufficient clothing. Rajahmundry is north and close to a large river, the Godavari; the variations in temperature, especially during the night, must be considerable. It was noticed the clothing was indifferent, not better than in the southern jails. There is no mortality, however, under this head, showing, as often previously remarked, how very amenable to treatment intermittent fever is. The mortality under all heads of fevers, considering the admissions were nearly 2,000, was small, only 8 cases, or about 4 per 1,000.

Cholera was answerable for 34 only of the 6,662 admissions into hospital, of which Cuddalore was responsible for 21 cases with 9 deaths. Cholera was very prevalent in the town of Cuddalore and neighbourhood during 1883. The medical officer in charge remarks:—"Epidemic cholera, which invaded the district in December 1881, continued during the "whole of last year (1883). In the jail there were three separate outbreaks in January, in

"September, and December. In January 11 prisoners were attacked and 7 died, in September "6 were attacked, of whom 2 died, and in December 4 were attacked, but all recovered. On "each occasion the prisoners were moved out to the camp jail at Mount Capper. On the first "occasion all the prisoners were moved and the jail buildings at Old Town were completely "vacated. On the subsequent occasions only about three-fourths of the prisoners were moved "out, some fifty, including civil debtors and under-trial prisoners, being left at Old Town."

The greatest number of prisoners (31) died in the Trichinopoly central jail, but this prison does not show the highest ratio of deaths per 1,000. Taken in the latter order we have Cotacamund (native jail) (65·69), Tanjore (86·21), Bellary (74·30), Cuddalore (73·86), Trichinopoly (55·16), and Kurnool (50·63). It will be as well to examine the cause of sickness and deaths in these respective jails.

In the Cotacamund native jail the undue sickness is attributed to "diseases mostly due to "alternations of temperature affecting gangs of men sent up from the plains, and weakly "men from Wynaad, whose constitutions were shattered by malarious fever." On turning to the tables we find the principal admissions into hospital were—fevers 37, respiratory diseases 12, diarrhœa 36. But the greatest number of deaths (5) is under "respiratory diseases."

Tanjore is an old jail and has long been condemned. The Medical Superintendent thus reports:—"The health of the prisoners for the year under review was not good. Dysentery and diarrhœa as usual constitute nearly two-thirds of the total admissions into hospital, and they as usual have been the chief causes of mortality. The diseases causing death were 7 from diarrhœa, 1 from dysentery, 1 from congestion of the brain, and the last from synovites on admission and pyæmia at his death."

In Bellary it is attributable chiefly to the inclemency of the cold weather, which was abnormally severe; the Superintendent reports:—"Out of a total of 8 deaths from dysentery "during the year 1883, 6 occurred in the rainy and cold weather, both of which were "abnormally severe, of these 6 cases, 2 were admitted into jail in 'indifferent' health, the "remaining 2 cases occurred, 1 in February, the other in June, the latter, a man, admitted "into jail suffering from dysentery, and whose health was marked 'bad' in the register, he "died shortly after admission into jail. As to the two cases of diarrhœa, 1 occurred in "March, a man who had been over 4 years in jail, the *post mortem* appearances were those "seen in cases, proving fatal from the effects of famine, so it is presumable he had suffered "severely from diarrhœa prior to his incarceration. The second case occurred in November "(cold season), 6 of the above cases of dysentery and one of diarrhœa, I attribute altogether "to severity of the weather, the variations in temperature being most trying, there was no "epidemic or anything wrong with the jail.

"Of the remaining number of deaths, 2 occurred in prisoners admitted into jail in "'indifferent' and 1, that of a man admitted in 'bad' health. Two other deaths of old men "were also recorded, both over 70; in these cases death may be fairly attributed to old "age. Another death also recorded during the year, was that of a man admitted into hospital "for rheumatism, but who died suddenly from 'embolism' as was elicited on making the *post* "*mortem*.

"Three other deaths, viz., 1 hepatitis, 1 bronchitis, running on to congestion of the lungs, "and 1 from general debility also took place during the cold and rainy season."

In Cuddalore the principal cause was epidemic cholera which caused 9 casualties. Four deaths took place from bowel-complaints induced principally by the diet now in use.

The Kurnool Superintendent is of opinion "there has been no undue sickness or mortality." It is a small jail with average strength of 79 convicts only and 4 deaths.

In the Trichinopoly Jail we have 31 deaths on an average strength of 561, equal to a death-rate per 1,000 of 55·2. During 1882 the death-rate was 162·5 per 1,000. Altogether during 1882 and 1883 174 prisoners died in the Trichinopoly central jail. This undue mortality—described by Surgeon-General Cornish in his inspection notes of August 1882 as the "old form of jail diarrhœa, dropsy, and dysentery which 20 years ago caused as "large a mortality in Madras prisons, undoubtedly due to *bad* or *imperfect nutrition*"—gave rise to a good deal of anxiety and inquiry, and for some time remained unexplained, but it is a melancholy satisfaction to know that it no longer remains a mystery; the cause has been elucidated.

General Population.

It has in various previous reports been remarked that the registration in Municipalities, carried on as it is by a registrar under the immediate supervision of the municipal authorities, is fairly correct. By G.O. No. 391 of 22nd February 1883, the civil medical officers have now been constituted also sanitary officers of their respective districts and are expected to

scrutinize the returns of births and deaths. This order has so recently come into force that it has as yet exercised no perceptible influence on district registration. According to a resolution of the Board of Revenue, in which Government concurred (G.O. No. 692, dated 3rd April 1884, Public), matters will remain the same for some time yet to come, and it will take a few years' experience to determine whether the G.O. No. 391 of 22nd February 1883 alluded to, if carried out in the manner here determined, has really effected any change in the mode and results of district registration.

The present returns are compiled from the census of 1881, the figures of which were not available for our last annual report. The total of population given by this census (exclusive of Europeans and Eurasians) is 30,835,771. There were 791,774 births registered during 1883, of which 404,937 were males and 386,837 females. The number of males born was in the proportion of 104·6 to every 100 females. The birth-rate per 1,000 is 27·7, the highest rate which has yet been reached. In England for the same period the ratio per 1,000 of births was 33·3, in Ireland 23·5. Births were much more numerous during the last than the first portion of the year. Out of a total of 791,774 births, 449,327 took place during the last and 342,447 during the first six months, and curiously enough each month of the latter had a higher total than the corresponding month of the first half of the year. On looking over past returns it is found that this preponderance of births during the last over the first half of the year constantly obtains.

The deaths registered during 1883 amounted to 541,930 in returns received from a population of 28,503,100. Of this number 278,485 were males and 263,445 females, giving 105·7 deaths of the former to every 100 of the latter. The actual number of deaths in 1883 was greater by 71,230 than in 1882, and the death-ratio per 1,000 is 19·0 against 16·2 of the previous year. But these ratios per 1,000 of births and deaths can after all, in India, be only approximate calculations, for it will be seen by studying the column of population how liable the totals are to be upset by a fresh numbering of the people. For instance, in 1871 the death-rate per 1,000 is 18·0, but in 1872 16·6 or nearly 2 per 1,000 less, and this not because less people died in 1872 than 1871, for if we look at the column of deaths we find nearly 60,000 more passed away, but because a census having been taken, it was found Southern India contained nearly six millions more people than the previous numbering gave us. So in the year under review the death-ratio per 1,000 suddenly rises from 16·2 to 19·0 not only because 71,230 more people died, but because also the new census has given us more than a third of a million less population.

The subjoined table shows the population, number of deaths registered, and the ratios per 1,000 for the last 15 years. Attention was drawn in last year's report to the very low death-rate per 1,000 for 1882, viz., 16·2, and it was then remarked that it pointed to a lower death-rate than obtained in the United Kingdom for the same year, viz., 19·2. The death-rate for this year, with a corrected numbering of the population, gives us, curiously enough, very nearly the same ratio per 1,000 as obtains in England, 19·0 to 19·7. It may perhaps be taken as evidence that our registration is getting yearly more accurate.

Years.	Population for which returns were received	Deaths.	Death-ratio per 1,000	Years.	Population for which returns were received	Deaths.	Death-ratio per 1,000.
1869	24,633,127	451,981	18·3	1877	29,209,542	1,556,312	53·2
1870	24,425,526	451,020	18·6	1878	29,127,205	810,921	27·8
1871	24,555,046	444,371	18·0	1879	28,991,267	549,390	18·9
1872	30,147,779	501,482	16·6	1880	28,778,097	454,101	15·7
1873	30,287,842	506,894	16·4	1881	28,676,375	465,682	16·2
1874	30,360,221	516,848	17·0	1882	28,887,111	470,700	16·2
1875	30,278,903	641,260	21·1	1883	28,503,100	541,930	19·0
1876	29,157,056	680,384	23·3				

Out of a total death-roll of 541,930, no less than 125,663, or nearly one-fourth, were children under one year of age. This represents a death-ratio of 158·7 per 1,000 of births, cholera, as usual, claiming many victims among infants.

The death-rate in districts amounted to 18·6 per 1,000 of the population against 24·9 per 1,000 in the town.

Below is given the usual table showing the deaths from different causes during the year under review compared with previous years. From this it will be seen that 1883 is the most sickly year we have had since 1878, the year succeeding, and still suffering from the effects of the famine. The year in other respects, viz., rainfall and food prices, had been a favourable

one, but the death-roll is swelled from all causes—not only cholera and small-pox, but also fevers and bowel-complaints.

Years.	Total Deaths.	Cholera.	Small-pox.	Fevers.	Bowel Complaints.	Injuries.	Other Causes.
1866 - - -	600,106	200,961	28,106	110,102	—	9,047	256,890
1867 - - -	372,026	33,205	27,907	112,511	—	8,613	189,790
1868 - - -	390,959	8,086	34,330	105,692	—	9,242	233,659
1869 - - -	451,981	21,034	17,448	132,346	—	9,310	271,843
1870 - - -	451,020	55,867	11,252	151,027	—	12,325	220,549
1871 - - -	444,371	17,656	20,823	192,469	38,928	15,323	159,172
1872 - - -	501,482	13,247	39,074	214,148	39,387	15,150	180,476
1873 - - -	506,894	840	51,784	222,843	36,392	14,251	180,784
1874 - - -	516,848	313	48,343	226,220	37,993	13,065	190,914
1875 - - -	641,260	94,546	24,775	252,042	37,484	12,421	219,992
1876 - - -	620,384	148,193	23,469	230,092	38,176	11,175	229,279
1877 - - -	1,556,312	857,430	88,321	469,241	133,366	16,460	491,494
1878 - - -	810,921	47,167	56,360	374,443	48,083	15,007	269,861
1879 - - -	549,390	13,296	17,840	285,477	23,218	12,619	196,940
1880 - - -	454,101	613	14,529	209,940	19,622	10,845	198,552
1881 - - -	465,682	9,446	15,776	203,542	18,961	11,527	206,430
1882 - - -	479,700	23,604	20,159	188,561	19,953	11,611	206,807
1883 - - -	541,930	36,284	37,975	203,786	22,098	11,509	230,278

Cholera.

The cholera which invaded Madras at the fall of the year 1881 continued in the southern provinces during 1882 and all 1883. The area infected was much the same, viz., the collectorates and districts lying south of the Madras (South-West) Railway and freely traversed by this and the South-East Line—Tanjore, South Arcot, Trichinopoly, Tinnevelly, North Arcot and Madura, as mentioned in the last annual report, to which must be added this year Salem and Coimbatore. The northern district almost entirely escaped as in 1882, but towards the end of the year it crossed the border line of railway and crept up to Nellore, from whence, by the last reports which have reached this office, it is gradually ascending to the Northern Circars, keeping to the line of the canal.

The total number of deaths registered from cholera during the year under review was 36,284, giving a death-rate of 1·2 per 1,000 of the population, the average of the previous five years being 0·6. The rate per 1,000 in the districts, exclusive of towns, was 1·1, in the municipalities and towns of 10,000 inhabitants and upwards 3·8.

Small-pox.

Small-pox was very fatal during 1883: no less than 37,975 deaths were reported under this head. It represents a death-rate of 1·3 per 1,000 of the population, and is a greater mortality than any year since 1878. The districts which suffered most were Malabar, Kistna, Cuddapah, South Arcot, North Arcot, Madras, Salem, and Coimbatore. The district of Madras is in reality the town or city of Madras within municipal limits. Being the seat of a collectorate, it falls within the definition of a district. Here small-pox was very prevalent and attended with great mortality despite the energetic efforts of the municipal authorities and Inspector of Vaccination to counteract it by the energetic extension of vaccination. Fresh vaccine depôts were opened in all parts of the town, and an increased number of vaccinators was employed to push this prophylactic. The poor people are, however, so firmly wedded to the belief that the disease is a visitation of the goddess Mariamma, and to be looked upon rather as a beneficent mark of her favour than any misfortune, that all merely persuasive efforts on the part of Europeans seem useless to combat the epidemic. Unlike in Europe, the educated native classes in this country treat the matter with supreme indifference; misfortune or sickness occurring in any other but their own immediate circle is a matter for the parties concerned and cannot possibly, in their estimation, interest anyone else. Hence there is no effort on the part of the people themselves to grapple with an epidemic of this sort as a public calamity. The only remedy is compulsory vaccination, and the new Municipal Act, which has become law as this report is being prepared, provides for the future in the district of Madras.

Infants and children under twelve years of age, as usual, formed the largest bulk of the returns. Out of a total of 37,975, the child mortality amounted to 28,309.

Fevers.

Fevers have this year, like small-pox and cholera, been more fatal than last year. There were 203,786 deaths registered under this head, giving a death-ratio of 7·1 per 1,000 of the population. As before remarked, fevers, although creating no sensation, carry off annually more victims than cholera and small-pox put together; the total mortality from both these

complaints in the year under review (and that a bad year) being only 74,259 as against 203,786 from fevers.

The deaths registered from fevers in the districts of the Madras Presidency during each month of the year of 1883, shew that it is during the cold and monsoon months that the greatest number of victims succumb to fever; that it is more a climatic than a mysterious malarial malady. When the poor people learn how to protect themselves by proper clothing and food from rapid changes of temperature, then the muster roll of deaths from fever will diminish.

Bowel complaints.

The deaths under bowel complaints were more numerous in 1883 than any year since 1879. As remarked in last year's report, when cholera is rife deaths from bowel complaints are more numerous than usual.

Vaccination.

During 1883 there were 753,589 persons vaccinated, being an increase of 88,921 over the previous year. Of the total vaccinated, 736,662 were primary and 16,927 re-vaccinations. Out of 736,662 primary operations 683,384, or 92·7 per cent., were successful, being the highest percentage shown during the last 10 years. This shows an improvement both in the quantity and quality of the work done. 16,927 persons were re-vaccinated, 7,860, or 46·4 per cent., being successful.

The total operations performed in Local Fund districts during the year under review amounted to 595,214 against 528,413 during 1882, showing an increase of 66,801 cases. There was an increase in all the districts except Vizagapatam, Godávari, North and South Arcot, Coimbatore, Trichinopoly, and Tinnevelly. As in 1882, children over one and under six years of age were the most largely protected, next those above six years, and lastly infants under one year of age. The largest number of infants successfully vaccinated (18,681) occurs this year in Madura District, the smallest number (335), excluding Nilgiris, as usual in Malabar. The total number of infants under one year of age vaccinated in 1883 was 104,017; total number of births 738,388. In many districts infantile vaccination is very backward, and this is due to the almost insurmountable objection mothers have to early vaccination. On the appearance of the vaccinator in a village it is a common custom for parents to send their children away to a neighbouring hamlet, and stoutly deny having any. On the whole, however, infantile vaccination during 1883 compares favourably with 1882, viz., 14·0 against 13·8 per cent.

In all the municipal towns vaccination was carried on with more or less success during 1883. In many municipalities vaccination, especially infantile vaccination, is backward, and the only apparent remedy would seem to be a Compulsory Vaccination Act as introduced in Madras lately. The total number of operations in municipalities during 1883 was 96,274 against 86,481 in 1882, showing an increase of 9,793 for the past year. An improvement in the percentage of successful cases is observed in primary vaccinations, viz., 92·1 against 90·9. The number of infants vaccinated under one year of age in municipalities falls short of the registered births. The figures are, however, higher than those of the previous year, viz., 25,498 in 1883 against 20,570 in 1882.

The work done by medical officers and subordinates attached to dispensaries for 1883 is slightly in excess of 1882. There were 267 dispensaries from which returns were received; during 1882 the number was 254, showing an increase of 13 for 1883. The returns received from 15 dispensaries were *nil*. The highest number of operations (352) was done in a dispensary at Madurantakam, and the lowest (1) in Bimlipatam and Triplicane dispensary.

In some districts, such as Ganjam, Vizagapatam, and Kistna, inoculation is much practised and greatly preferred by the people to vaccination. As this greatly impedes the progress of vaccination, the Inspector of Vaccination suggests that an Act be passed prohibiting inoculation in those districts where a vaccinator is procurable. Inoculation was originally introduced by the British Government, so that its suppression would scarcely be an interference with the caste prejudices of the people.

Sanitary Works.

Municipalities.

The sanitary works executed and those that were in progress at the close of the year in each municipality consisted in the main in the repairing and cleansing of tanks and wells, latrines, drains, dust-bins, markets, and slaughter-houses; in the removing of prickly-pear bushes and other rank vegetation; in the construction of latrines, drains and dust-bins; in the sinking of a few wells, and in some other minor works.

Greater attention appears to have been paid in certain towns than in others to drainage and water-supply, especially in Madura. The situation of some towns is such that the question of an efficient and regular system of drainage is rendered difficult of solution.

The system of conservancy adopted in the several towns during the year under review was much the same as in former years. A scavengering establishment, supervised by a staff of inspectors, overseers, &c., is employed in each town to keep it clean and attend to its conservancy. The street sweepings, other refuse matters, and contents of dust-bins and latrines are removed daily and carted away outside of the limits of the municipality, and are either buried in trenches, thrown into fields, sold as manure, or consumed in cinerators and converted into poudrette for agricultural purposes. In some few towns the street sweepings and other inoffensive matters are made use of in filling up hollow places. The latrine accommodation in certain towns was increased by the erection of new latrines. During the year several of the municipalities have undertaken private scavengering: this is a step in the right direction, and it is hoped that in course of time it will be followed by all the municipalities in the Presidency. It will not only ensure greater cleanliness in the backyards of native houses, but may prove a source of income to the municipal funds. Particulars in regard to water-supply, drainage, and conservancy will be found in the abstract of the sanitary reports which follow. On the whole, the reports show progress year after year in conservancy and other sanitary arrangements.

The total estimated income of all the municipalities, exclusive of Madras, for the year 1883–84, amounted to Rs. 17,20,210, representing an incidence of Rs. 1.4.9 per head of population. In 1882–83 the income amounted to Rs. 15,96,920 and the incidence Rs. 1.3.3 per head of population according to census of 1881. Thus it will be seen that the income of 1883–84 exceeded that of the preceding year by Rs. 1,23,290; and it is gratifying to note that with this increased income the sanitary allotment also was raised from Rs. 4,95,536 in 1882–83 to Rs. 5,71,199 in 1883–84, representing a percentage to income of 38·2 against 31·0 in 1882–83. Excepting two towns, Calicut and Nellore, which show a low percentage of 15·1 and 17·8 respectively, the allotments made by all the other towns for sanitary purposes appear to be fair; in 36 towns the percentages ranged between 20 and 40, in 7 they were above 40 and below 50, and in 2, Cotacamund and Kumbakónam, the percentage was as high as 60·3 and 50·1 respectively. Increased provision over that for 1882–83 appears to have been made for all except one of the different specified objects of sanitation, viz., conservancy, improvements of water-supply and town sites, construction and repair of markets and slaughter-houses, and other sanitary objects. The allotment for sanitary arrangements during fairs and festivals is slightly below that of the preceding year, though the expenditure under this head for 1882–83 exceeded the sanctioned grant.

Of the total sanitary allotment, Rs. 3,93,828 were spent in nine months ending with December 1883, leaving Rs. 1,77,371 to be spent in the following three months of the official year. Taking, however, the figures for 1882–83, which represent the expenditure for the whole year, we find that out of a sanctioned allotment of Rs. 4,95,536, only Rs. 4,47,153 were spent, leaving Rs. 48,383 unutilized; excepting the expenses incurred for sanitary arrangements during fairs and festivals and construction and repair of markets, &c., which exceeded the sanctioned grant somewhat, the allotment for the other sanitary purposes do not seem to have been fully made use of.

Local fund circles.

Sanitary reports were received from all the circles, 30 in number. No material change was made in water-supply, drainage and conservancy during the year under review; the system was the same as last reported. The principal sources of water-supply were as usual tanks, wells, rivers and irrigation channels. But greater attention is now being paid to the conservation of the several sources used for drinking purposes in the majority of the circles. Drainage consisted, as usual, in side-ditches cut chiefly to carry off storm-water; excepting in a few cusbah towns, there is no regular system of drainage anywhere. The drainage from houses flows into cesspools or runs into the backyards, where the water soaks into the soil. Conservancy, on the whole, appears to have retrograded rather than improved, for the allotment under this head was reduced from Rs. 1,81,791 in 1882–83 to Rs. 1,63,006 in 1883–84, and the number of towns and villages conserved fell from 640 to 576. This backward movement is observable in seven of the circles, notably so in Guntúr, Tanjore and Madanapalle, where the number of villages conserved was reduced from 51 to 16, from 38 to 14, and from 28 to 5 respectively; in three other circles the numbers fell from 18 to 12 in Trichinopoly, from 30 to 25 in Negapatam, and from 24 to 23 in Cuddapah. It is remarkable that the Guntúr circle has fallen back as regards conservancy, for this circle used formerly always to head the list as to the number of villages conserved in it. No reason has been assigned for this retrogression. The available income, *i.e.*, one-third of the land-cess,

was the same as in the preceding year, viz., Rs. 43,333. The backwardness in Tanjore, Madanapalle, Anantapur (formerly Penukonda), and Trichinopoly was noted in last year's report also, and it is to be regretted that these circles have not endeavoured to retrieve their lost places on the list during the year under notice, but have made a still further downward movement. Scavengering establishments of varying strength were employed in 576 towns and villages during the year. These establishments were generally under the control of the local revenue officers, but in the Madura and Salem districts they were supervised by sanitary associations or local committees. In the Cuddapah district the contract system was in force in some places, and in Vizagapatam, besides the permanent scavengering staff in certain towns and villages, itinerating establishments were employed in other villages with the object of gradually improving the sanitary condition of all the villages in the circle; they seem to have done good work.

The sanitary works carried out during the year and those that were in progress, consisted as usual in the construction and repair of markets, slaughter-houses, latrines and dust-bins, in the excavating of tanks, and sinking of wells, in the repairing of tanks, wells and drains, in removing prickly-pear and other rank vegetation, and some other minor works. On the whole the reports show progress. The aggregate available income, *i.e.*, one-third land-cess, amounted to Rs. 13,84,627 for 1883–84 against Rs. 13,41,991 for 1882–83, *i.e.*, the income for 1883–84 exceeded that of the preceding year by Rs. 42,636. Sanitation does not, however, appear to have benefited by this increased income; it seems to have suffered for the aggregate budgeted sanitary allotment, including the item construction and repair of markets and slaughter-houses, fell from Rs. 4,37,259 for 1882–83 to Rs. 3,99,672 for 1883–84, *i.e.*, it was less by Rs. 37,587 during the year under review. Two of the most important objects of sanitation, viz., conservancy and improvement of water-supply (the greatest need in India), appear to have suffered by the reduction. The allotment for conservancy, as might have been expected by a reduction in the number of towns and villages conserved, fell from Rs. 1,81,791 in 1882–83 to Rs. 1,63,006, that for the improvement of water-supply from Rs. 1,23,043 to Rs. 84,581; there appears, however, an increase in the allotments for the improvement of village sites and other sanitary objects of Rs. 9,089 and Rs. 15,972 respectively. The provision made for sanitary arrangements during fairs and festivals was the same as that for the preceding year, and the allotment for the construction and repair of markets and slaughter-houses fell from Rs. 62,570 to Rs. 58,068.

Taking the figures for the year 1882–83, which represent the expenditure for the complete year, we find that out of a sanctioned allotment of Rs. 4,37,259 only Rs. 3,49,521 were spent during the year, leaving Rs. 87,738, or 20·0 per cent., unexpended. The allotments under every one of the items except "other sanitary objects" (and what these consist in is not known) have not been fully utilized, which is very much to be regretted. It cannot be said that nothing was required to be done and so the money was not expended. It is to be hoped, however, that recent orders of Government and of the Board of Revenue on the subject will in future have the desired effect towards the complete utilization of funds placed at the disposal of the local authorities for sanitation, and that as skilled agency has now been provided by the appointment of district medical and sanitary officers for indicating and devising measures by which the funds of the local boards can be most advantageously expended, conservancy and improvement of village sites and water-supply—the greatest sanitary needs of a locality—will receive due attention, and the expenditure on their account will be strictly watched.

In the year under review (1883–84) the available income, as previously stated, amounted to Rs. 13,84,627; of this sum Rs. 3,99,672, or 28·8 per cent., were sanctioned for sanitary purposes, including the provision made for the construction and repair of markets and slaughter-houses. Excluding them, the allotment stands at Rs. 3,41,604, or 24·6 per cent. of income. Of the total amount, Rs. 2,11,865 were expended in nine months of the year ending December 1883, leaving the remainder, Rs. 1,29,739, to be spent in the following three months. 28·8 per cent. of income may be accepted as a fair sanitary allotment on the whole, though it falls somewhat short of the minimum. In some few circles the percentage has been very low, viz., Malabar 2·5, Canara 7·0, Madanapalle 10·3, Cocanada 13·8 Chatrapur 14·3, and Madura 15·0. For exceptional reasons the allotments made by the Local Boards of Malabar and Canara are always small, and in Madura the allotment is supplemented by contributions from sanitary associations. In all the other circles the percentages were above 20, and in some they were as high as 83 in Coimbatore, 55 in Negapatam, 52 in Nilgiris, 51 in Ellore, 43 in Hosur, 35 in Chittoor, 33 in Cuddalore, Masulipatam, Salem, and Kurnool, and 30 in Tanjore.

General Remarks.

During 1883 every municipal town in the Presidency was visited by the Sanitary or Deputy Sanitary Commissioner. The inspection reports were forwarded as usual to Government, and circulated to the President and Vice-President of the various Municipalities and Local Fund Boards.

It was noticed in last annual report that considerable progress had been made in sanitary matters; this progress has been in many places, as lately remarked by Government, fully maintained. The Commissioners are becoming more and more alive to their responsibilities and duties. The President of the Municipality of Madura speaks in the highest terms of the activity which is exhibited by the members in the management of local affairs, and the Right Honourable the Governor in Council believes that other municipalities are in no way behind Madura in public spirit.

During April, May and June, the present incumbent was absent on privilege leave. Surgeon-Major Bidie, C.I.E., acted as Sanitary Commissioner during those months. On my return to duty, one of the first questions which came under consideration was a supposed epidemic sickness amongst fish, rendering them unfit for food. As fish form an important portion of the diet of fully two-thirds of the people, it was at first sight a serious question. The alarm on this point had been started at Pondicherry, and had gradually spread up the coast to Madras. The subject was referred to this department, and, as the report is short, it is given *in extenso* (Appendix B). It is but fair, however, to mention that although the report is concise, this in no way represents the amount of labour it entailed. Every morning from 6 A.M. to 10 A.M., for several weeks, was given up to dissection and microscopical examination, and moreover, a mass of literature on the subject had to be mastered. It was gratifying to receive, after the report had gone in to Government, a note from Professor Cobbold, fully corroborating the conclusions arrived at. The subject was new and intensely interesting, but I am sorry that subsequent touring and the increased work in the office brought about by the late re-arrangement of sanitary work in the provinces have precluded my finishing the sketches alluded to.

During the year under review the German Cholera Commission, consisting of Drs. Koch, Fischer, and Kaffgy, visited Madras. Unfortunately their stay was very short; they were simply *en route* to Calcutta. They did me the honour to call, and I tendered them all the assistance and information in my power. At the time of their visit cholera was raging very severely at Madura, whither I invited them to accompany me, but their engagements, much to their regret, precluded their doing so.

ABSTRACT OF REPORT OF THE SANITARY COMMISSIONER FOR BOMBAY FOR 1883.

(*Deputy-Surgeon-General T. G. Hewlett.*)

Introductory.

Healthiness of the year.

The year 1883, as will be shown more fully in the following section, was an unhealthy one. There was not only a widespread epidemic of cholera, but small-pox prevailed to a large extent over a great portion of the Presidency, whilst fevers also were in excess of the mean.

Fears were at one season of the year entertained that the locusts would cause a scarcity, if not famine, over extensive areas of the Deccan and the Konkan, but the energetic measures taken in the affected districts by order of Government for their destruction, were in a great degree successful, whilst the strong easterly breeze that set in at the termination of the rains, blew them in great numbers out to sea, where they perished.

Rainfall.

Unusually heavy rain accompanied the setting in of the south-west monsoon in June, whilst the easterly rains in September and October were more abundant and prolonged than usual, so that with the exception of the collectorates of Kaládgi, Kaira, Ahmedabad, and Sind, the rainfall in each of the remaining districts of the Presidency was above the annual mean.

General Population.

Vital statistics.

The total population of the Presidency, including the military, amounted at the census of 1881 to 16,454,414 (males 8,497,718, females 7,956,696). The total area occupied by this population is 123,860 square miles, and the average density was 132·85 per square mile.

In the Presidency of Bombay, including Sind, during 1883, the births of 261,966 males and 239,835 females, or a total of 501,801 children, were recorded against 255,927 boys and 235,419 girls, or a total of 491,346 children, in 1882. The births for 1883 are thus 10,455 in excess of those for the previous year, whilst they exceed the mean of the preceding 10 years ending 1882 by 154,391.

The following table shows the number of births registered in each year from 1873 to 1883, their ratios per 1,000 of population, and the proportion of males to females. The ratios are calculated on the total population, not as hitherto on the total of male and female populations :—

Years.	Number of Births Registered.			Rates per 1,000 of Population.			In every 100 Born there were		For every 100 Male Births the Females were
	Males.	Females.	Persons.	Males.	Females.	Persons.	Males.	Females.	
1873	*152,520	*137,799	*290,319	9·39	8·49	17·88	52·54	47·46	90·35
1874	174,966	157,842	332,808	10·81	9·75	20·56	52·57	47·43	90·21
1875	178,392	161,927	340,329	11·05	10·01	21·06	52·49	47·51	90·52
1876	181,872	163,612	345,484	11·24	10·11	21·35	52·64	47·36	89·96
1877	164,262	147,399	311,661	10·15	9·11	19·26	52·75	47·25	89·73
1878	126,348	114,405	243,253	7·96	7·07	15·03	52·97	47·03	88·79
1879	151,460	136,410	287,870	9·38	8·41	17·74	53·61	47·39	90·06
1880	195,285	175,588	370,873	12·08	10·82	22·85	52·66	47·34	89·91
1881	239,913	219,745	459,657	14·58	13·35	27·93	52·19	47·81	91·59
1882	255,927	235,419	491,346	15·55	14·31	29·86	52·09	47·91	91·98
Mean for 10 years	182,394	165,016	347,410	11·21	10·14	21·35	52·50	47·50	90·47
1883	261,966	239,835	501,801	15·92	14·58	30·50	52·20	47·80	91·55

* N.B.—Inclusive of still-born.

It is satisfactory to notice the progressive improvement that, except in the three years of famine, has taken place in the registration of births, yet the birth-rate for 1883 (30·50 per 1,000) is below the birth-rate of some European countries.

The number of births registered in 1883 is higher in each of the five divisions than that recorded in 1882 except in the Northern Deccan, in which only 139,000 births were

registered against 144,865 in the previous year; but the registration still continues to be very defective in the Konkan and in Sind, and the carelessness exhibited in these two districts in this respect destroys the value of our statistics.

The total increase for the Presidency was 9·15 per 1,000 of population above the mean of the preceding 10 years, whilst in the following 13 districts, viz. :—Poona, Sholápur, Belgaum, Dhárwár, Kánara, Kolába, Thána, Broach, Kaira, Ahmedabad, Hyderabad, Thar and Párkar, Upper Sind Frontier, the number of births in 1883 is higher than in 1882.

It is most disappointing again to notice, as Mr. Lumsdaine pointed out in his last report, that the registration of births, in the city of Bombay, shows no improvement although an increased registration establishment has, for upwards of three years, been entertained. The highest birth-rate in 1883 (44·09) took place in the Dhárwár Collectorate, and the lowest (15·92) in the Hyderabad Zillah.

The birth-rates for the Presidency among the urban and rural population were respectively 25·07 and 31·29 against 25·07, and 30·56 in 1882; the birth-rates recorded among the rural population of each district except in Kánara, Ratnágiri, Ahmedabad, Karáchi, Hyderabad, and Shikárpur were higher than the birth-rates registered in the town circles.

In Kándeish, Násik, and Bombay City the birth-rates in 1883 were lower than the death-rates. This may perhaps, as regards Kándeish and Násik, be partly due to there having been a severe epidemic of cholera and small-pox, but in Bombay City it is clearly due to defective registration. In Ahmednagar and Poona Collectorates the birth and death-rates were nearly balanced. In all the other districts the recorded birth-rates are higher than the recorded death-rates. This is especially noticed in the following districts :—

Districts.	Birth-rates, 1883.	Death-rates, 1883.	Districts.	Birth-rates, 1883.	Death-rates, 1883.
Sátára - - -	38·35	23·15	Kaládgi - - - -	35·14	21·46
Belgaum - - -	40·60	22·23	Kaira - - - -	36·03	25·11
Dhárwár - - -	41·09	24·74			

It is most satisfactory to notice this fact especially in the districts of Belgaum, Dhárwár, and Kaládgi which suffered so severely during the famine, and the high birth-rate prevailing in them not only proves that the fecundity of the people has returned to its normal state, but is in accordance with the law that "after the ravages of plagues the births increase; for "example, the London bills of mortality showed 64,544 christenings in the ten years, "1651–60, before the Great Plague, and in the ten years 1661–70, including the year of the "Great Plague, 106,755 births."—*Farr.*

In 1883 among the Civil population in the town, rural and Cantonment circles of the Presidency of Bombay the deaths of 221,110 males and of 199,088 females, or a total of 420,198 persons, were recorded. In the previous year 343,418 deaths, or 76,780 less than in 1883 were registered. The following statement shows the number of deaths registered in each year since 1872 :—

1872 -	367,057	1876 -	368,260	1880 -	328,673
1873 -	290,972	1877 -	627,708	1881 -	381,450
1874 -	278,652	1878 -	532,951	1882 -	343,418
1875 -	375,718	1879 -	387,542	1883 -	420,198.

Excluding the famine years (1877–78) the deaths in 1883 were far more numerous than in any year of the series.

The computed death-rate per 1,000 of population in 1883 was 25·53 against 20·87 in 1882, the decennial mean being 24·06. Omitting Sind, where the mortuary registration is extremely defective, the death-rate in the other parts of the Presidency amounted to 27·32 per 1,000, of population.

The deaths in 1883 by districts ranged from 41·97 per 1,000 in Kándeish to 9·19 in the Upper Sind Frontier. In 1882 the maximum ratio (26·16) was in Bombay City and the minimum (9·90 in the Upper Sind Frontier.

In 17 districts the death-rate per 1,000 of population in 1883 was higher than in 1882, the difference being most marked in—

Kándeish where	41·97	deaths per 1,000 were registered against	22·07	in	1882.
Násik . „	33·80	do.	do.	24·77	do.
Ahmednagar „	38·56	do.	do.	19·51	do.
Poona „	28·60	do.	do.	17·84	do.
Sholápur „	29·11	do.	do.	18·99	do.
Surat „	31·44	do.	do.	22·81	do.

It was also higher than the annual mean of the preceding 10 years in the following 12 out of the 24 districts, viz. :—

Kándeish.	Poona.	Thána.	Thar and Párkar.
Násik.	Sholápur.	Surat.	Shikrápur.
Ahmednagar.	Kolába.	Hyderabád.	Upper Sind Frontier.

The mortality amongst infants under one year and children above one year but under 5 is terribly high in comparison with other periods of life. In fact the deaths in children under 5 years of age formed 40·54 per cent. of the total deaths. The period of greatest immunity was in the period "above 10 and under 15," the rate being 7·75 per 1,000. For those "above 60 and upwards" the mortality was at the rate 58·73 per 1,000. The percentage on total deaths amongst infants under one year is 21·35 against 22·11 in 1882. For those "above 1 and under 5" the percentage on total deaths is 19·19 against 16·72 in 1882. For old people "above 60 and upwards" the percentage on total deaths is 10·38 against 11·28 in 1882.

The subjoined table shows the deaths in 1883 arranged according to the specified causes laid down by the Government of India and contrasted with the results for 1882 and the mean of the preceding 10 years :—

Deaths by Causes.	Mean for 10 Years, 1873–82.		1882.		1883.	
	Number.	Ratio per 1,000 of Population.	Number.	Ratio per 1,000 of Population.	Number.	Ratio per 1,000 of Population.
Cholera	21,621	1·33	7,904	0·48	37,954	2·31
Small-pox	6,522	0·40	1,630	0·10	13,404	0·81
Fevers	255,531	15·70	243,454	14·80	266,741	16·21
Bowel complaints	33,150	2·04	28,353	1·72	35,292	2·14
Injuries	6,440	0·40	5,913	0·36	5,978	0·36
All other causes	68,270	4·19	56,164	3·41	60,829	3·70
All causes	391,534	24·06	343,418	20·87	420,198	25·53

Cholera.

During 1883 cholera caused 37,954 deaths throughout the Presidency. The epidemic was most severely felt in the Northern Deccan Registration District, as 30,298 of these deaths were recorded in it, of which 10,914 took place in Kándeish; but the highest death-rate (9·81 per 1,000) occurred in the Ahmednagar Collectorate. No deaths from this disease were recorded in the Sind District.

The deaths from cholera in each of the 18 years ending 1883 were as follows :—

1866	23,027	1872	15,642	1878	46,743
1867	5,143	1873	283	1879	6,937
1868	6,347	1874	37	1880	684
1869	52,330	1875	47,555	1881	16,694
1870	2,666	1876	32,117	1882	7,904
1871	5,821	1877	57,252	1883	37,954

so that the number of cholera deaths in 1883 exceeds the decennial mean by 16,333 and those in 1882 by 30,050, and was only exceeded in 1869, when 52,330 deaths were registered, in 1875 when 47,555 were recorded, and in 1877 and 1878, when the deaths ascribed to cholera amounted to 57,252 and 46,743 respectively.

Taking the mortality by districts, the highest number of deaths 10,914 = 8·82 per 1,000 of population took place in Kándeish District, whilst the highest death-rate occurred in the Ahmednagar District, as there were 7,368 deaths = 9·81 per 1,000. Next in order comes the Poona District, where the deaths amounted to 5,279, and following it the Násik District, where they were 4,193. In the Sholápur and Thána districts they were between 2,000 and 3,000. In the Kaládgi, Sátára districts, and in the city of Bombay between 1,000 and 2,000 deaths were recorded. In the remaining 10 districts they were under 1,000. It is worthy of special note that not a single case of cholera was reported in any of the five districts of the Sind division.

Out of the 285 registration circles into which the Presidency is divided (223 rural, 55 town and 7 cantonment circles), 174, namely,—131 rural, 37 town, and 6 cantonment circles were affected with cholera.

These deaths are distributed over 3,242 registration units, viz., 37 towns, 6 cantonments, and 3,199 villages. Regarding these latter, it is as well to explain that although the Census Report shows that there are in the Presidency 167 towns each containing 5,000 inhabitants or more, yet in our tables only 55 towns have been selected as urban registration circles, the statistics of the remaining 112 towns are necessarily included in the rural circles to which they belong and are classed as villages. Out of the entire population of the Presidency (16,454,414) 4,839,007 persons or 29·41 per cent. were living in the affected districts. Of these 37,954 or 7·8 per 1,000 died. Out of 24,536 inhabited villages in the affected districts, 3,199 or only 13 per cent. were affected with cholera.

Small-pox.

During 1883 small-pox prevailed in an epidemic form more or less throughout the Presidency, and 6,895 males and 6,509 females fell victims to it. The total deaths amounted to 13,404 against 1,630 in 1882, the decennial mean being 6,522. Small-pox thus caused 3·18 per cent. of the total mortality of the year.

The number of recorded deaths from small-pox increased from 539 (the lowest number attained since registration commenced) in 1881 to 1,630 during 1882. In fact the epidemic of the year under report commenced in November 1882, when 201 deaths against 98 in the preceding month—October—were registered. It prevailed with increasing severity until March, when it attained its maximum intensity, 2,814 deaths having been recorded in that month. It then commenced to decline, but the disease did not die out; on the contrary, it showed signs of epidemicity at the close of the year as the deaths rose in December to 1,033 or 640 above the decennial mean of that month. The minimum mortality, as a rule, occurs in the month of October, but the setting in of the cold weather appears to favour the development of the poison, and it rapidly becomes more intense until March, when it usually commences to abate.

By districts the highest ratio per 1,000 of population (2·18) took place in Surat against 0·15 in the previous year and the decennial mean of 0·63. The next highest ratios occurred in Kándeish 1·90, Bombay City 1·85, Thána 1·82, Poona 1·36, and Kaládgi 1·02. The only district from which no deaths from small-pox were reported was the Upper Sind Frontier—a like immunity was observed in 1882—whilst only 4 deaths were recorded in the Shikárpur Collectorate, and 13 in the Thar and Párkar District, a similar number being reported from Kaira. The death ratio from small-pox during 1883 was lower than the mean in Sholápur, Kánara, Kaira, Panch Mahals, Ahmédabad, and Shikarpur districts.

In the following table the deaths are shown by age and months, the latter being contrasted with the corresponding months of 1882 and with the previous five years. In 1883, 33·9 per cent. of these deaths occurred among infants under one year of age, whilst 51·9 per cent. took place among children over 1 and under 12, the remaining 14·2 per cent. being among persons over that age:—

		January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Total deaths from small-pox in each month	(5 years' mean	153	205	331	283	213	146	100	49	40	34	54	135	1,743
	1882	41	46	66	107	120	146	146	28	61	98	201	470	1,630
	1883	1,039	1,947	2,814	2,228	1,296	830	616	400	333	302	446	1,033	13,404
Deaths under 1 year	(5 years' mean	43	70	116	98	66	38	18	10	9	8	9	26	395
	1882	15	7	14	25	25	19	23	17	18	21	31	96	311
	1883	342	655	992	795	459	265	218	103	122	105	138	319	4,544
Above 1 and under 12 years	(5 years' mean	68	95	164	136	94	60	40	19	13	9	10	56	773
	1882	14	10	21	36	40	58	39	29	22	20	63	203	555
	1883	581	1,069	1,578	1,139	672	352	248	221	196	143	190	476	6,965
Above 12 years	(5 years' mean	42	40	51	60	53	48	42	20	18	17	26	53	470
	1882	12	28	21	46	55	71	98	52	41	57	107	180	758
	1883	116	223	240	244	185	180	155	71	65	36	118	238	1,900

In towns especially there is a large number of persons, chiefly young children, who are unprotected by vaccination against small-pox. I think a general feeling is gaining ground that the time is fast approaching when it will be desirable to make vaccination compulsory throughout the Presidency. If it were so there is no doubt that the death-rate would in epidemic seasons be considerably lower than it has hitherto been.

Fever.

During 1883, the deaths of 140,015 males and 126,726 females, or a total of 266,741 persons, were ascribed to fever. In 1882, 243,454 persons were said to have died from this cause. The increase therefore for the year under report as compared with 1882 amounted to 23,287 deaths, the mean for the previous 10 years being 255,531.

By districts the Collectorate of Kándeish heads the list with a millesimal rate of 24·71 against 17·65 in 1882 and 15·82 in the previous 10 years, and the following districts have exceptionally high rates: Broach 23·12, Surat 22·27, Násik 21·12, Ahmednagar 20·27, Kaira 20·09, Thána 19·24, Sholápur 18·71, and Ahmedabad 18·55. The minimum rate (7·47) was reported from Bombay City, and the following districts have comparatively low ratios: Ratnágiri 8·42, Upper Sind Frontier 8·47, Karáchi 10·75, Belgaum 11·07, and Dhárwár 11·71.

In speaking of fevers in Sind, Dr. Peacocke, the Acting Deputy Sanitary Commissioner, makes the following appropriate remarks, with which I concur:—

"In 1881, the total deaths from all causes were 31,914, of which 27,575 were from fevers.

In 1882	-	42,337	do.	37,785	do.
In 1883	-	36,582	do.	31,558	do.

"This enormous ratio of deaths from fevers is very remarkable, and the unfavourable "pre-eminence of 1882 is worthy of notice. To the inquiries made at the larger towns and "dispensaries I have been told that 1883 was much less unhealthy than 1882. This "statement is we see fully justified by the returns, which, however unreliable in themselves "as to accurate information, are yet useful in so far as they support mere statements.

"It must be gathered that fevers are the greatest cause of mortality in Sind, and a few "words on its causes will not be without interest. The chief cause may no doubt be found "in flooding of the country by the River Indus. The inundation of 1882 stands unrivalled. "Vast tracts of land in certain districts were covered four months with the water which "overflowed from the canals. These districts became very unhealthy, and severe fevers, "resulting in a largely increased death-rate, followed. The Shikárpur District was perhaps "that most severely affected, and although the death-rate of 1883 does not compare "favourably with that of 1881 (although the country was free from flooding in 1883), I "believe the increase in the number of deaths in 1883 over 1881 must be in a great measure "attributed to latent disease induced by the malarious influences of 1882. I have made "these few observations more especially in connection with my statement of last year that "the greatly increased mortality from fevers in the Shikárpur District in 1882 was due to "the inundation, and also in confirmation of the opinion expressed in my report No. 126 of "the 18th February 1883 as to whether irrigation from canals was conducive of malarious "fevers."

Bowel complaints.

During 1883, bowel complaints caused the deaths of 19,394 males and of 15,898 females, or a total of 35,292 persons against 28,353 deaths in 1882 and a decennial mean of 33,150. The North Deccan Registration Division heads the list with the very high ratio of 3·36 per 1,000 against 2·27 in 1882 and 2·41, the decennial mean. Following it comes the Southern Deccan with a ratio of 3·17, and next to it is Gujarat 2·09, after which is the Konkan 1·03, and the least of all Sind 0·21, the rate in this division being less than in 1882, 0·24, but slightly above the decennial mean, 0·20. In the Presidency the rate was 2·14 per 1,000 against 1·72 in 1882 and 2·04, the decennial mean.

Injuries.

During 1883, 3,436 males and 2,542 females, or a total of 5,978 persons, met with violent deaths. The mortality from these causes is slightly in excess of that in 1882 when 5,913 deaths were recorded. Of the 5,978 deaths 2,713 were caused by drowning, 1,215 resulted from snake-bites, 355 from wounds, 179 by hanging, 130 by poisoning, 95 from attacks by wild beasts, and 1,291 from causes not specified.

Other causes.

The recorded deaths from causes other than those specified, numbered 60,829, of whom 31,513 occurred among males, and 29,316 among females. The total for 1882 was 56,164, so for this year there is an increase of 4,665.

In concluding this section of the report on the chief diseases, I would desire to point out that great and terrible as the mortality from cholera during the year 1883 was, as by it alone 37,954 deaths were caused, yet that fevers were more than seven times as deadly, as from them no less than 266,741 persons, more than a quarter of a million human beings, lost their lives.

Cholera, from the rapidity with which it destroys, is more appalling to the popular mind, but fever is the cause of a far higher mortality.

The measures which are necessary to lessen the direful effects from these two causes are those which have been brought so frequently and so prominently to notice by the Army Sanitary Commission; the improvement of the water-supply and the cleaning of the

surface, and the drying and aration of the subsoil of the inhabited areas throughout the Presidency.

Government has sanctioned standard plans for barracks, latrines, &c., but it seems to me that above all is required a standard plan for wells. The following is the description of a well, as it should be, by the Army Sanitary Commission :—"Where a cesspit has been close "to the house well, it would be better to fill the well up with clean earth, and dig another "as far as possible from the site of the cesspit. All new wells should be cased outside "with clay or cement, or with concrete, to a sufficient depth to cut off the surface or subsoil "water from the well.

"The well is dug and built up in the usual way, but when it comes within 8 or 10 feet "of the surface the tube must be coated outside with puddle or concrete, to cut off the upper "portion of the water. The tube of the well should be carried two feet above the ground "level, and covered with a roof; the ground round the well should also be coated with "concrete, and sloped away from the well to open channels. With these precautions, which "are not difficult to take, and not costly, any well within a compound, except in very foul "ground, would yield wholesome water."

I would hope that Government will be pleased to direct increased attention to be paid to the conservation of all sources of water-supply, both in towns and villages, throughout the Presidency, and especially that no new well, the water of which is to be used for drinking, shall be constructed except on the plan recommended by the Army Sanitary Commission.

I also hope that measures may be taken to improve the quality of the water in those towns, which are dependent solely on rivers for their supply. In some such in Gujarát and in the south it is possible to dig wells on the river banks; and this course would probably be the best to adopt, but over great parts of this Presidency this action would do no good because the river bed is formed on the hard trap rock, and there would be no filtration through the soil, but it seems to me some rough means of filtration might be adopted. Whether in small rivers by building during the fine season a thick wall of sand across the bed, or part of the bed, or by digging reservoirs on the side and making the water passing into them, filter through a thick layer of sand, or as suggested by Mr. McLaren, R.E., by having walls holding a filtering medium made in the bed of the river from which the people could draw water during the fine season. But in drawing attention to the subject, I desire to point out, in the strongest way I can, the great danger of drinking river water, which has received the impurities of villages situated further up its course.

The decreased mortality from cholera in Bombay and in other cities where a pure water-supply has been introduced, is a convincing proof that it is the first great line of defence against cholera.

The geological formation of the greater portion of the Presidency forbids the hope that artesian wells would be of any service in most of the districts; but in Gujarát, perhaps, they might be tried with a probability of success, which, if attained, would solve one of the most difficult problems in that part of the country.

The people, however, are too poor to make the experiment; but I would hope that Government will be pleased to devote a portion of the public funds for the purpose of experiment.

The one great cause of fever throughout India is the existence of dampness in an impure and foul surface and subsoil in inhabited areas. I by no means forget the general malarious character of many parts of the country, but I am certain that most of the disease in India is due to local insanitary conditions around and in the midst of the habitations of the people.

It is clear that sanitation must begin at the houses of the people before any great reduction in the death-rate can be looked for. It cannot, however, be carried on without a constant and heavy expenditure. Government gives a special allowance for education, and I would respectfully venture to express my opinion that the preservation of health is as great a boon to the masses as the culture of the mind. It may be said, that as education spreads, the people will be led to see the great calamities they suffer from by such a heavy mortality taking place year by year in their midst, and gradually see the necessity for taking measures to prevent it. That is very true, but when I see that no less than 170,327 children were in a single year cut off before they had attained their fifth year of life, I should fail in my duty if I did not ask Government to provide in some way for the removal of the insanitary conditions to which these deaths are due.

I believe if the object were properly explained to them, the people of India would readily submit to a special tax for sanitary improvement, *if only the money so collected, were spent in the improvement of each individual village from which it were received.* The people of India are by instinct a cleanly race; they wish to be clean, but they have no idea of united

action so as to carry out those structural works by which alone, for example, the subsoil can be dried, or water after domestic use be removed to a distance from habitations.

I believe that the leaders of native thought would support the introduction of such a tax, for there is no measure which would conduce more materially to the real and permanent welfare of their countrymen, or would save an amount of human misery which it is perfectly lamentable to contemplate.

Vaccination.

The following table contrasts the work amongst the civil and military population during the year under report with that for 1882–83 :—

Establishment.	Persons primarily vaccinated.				Persons re-vaccinated.				Total Number of Persons operated on.			
	1882-83.	1883-84.	Increase.	Decrease.	1882-83.	1883-84.	Increase.	Decrease.	1882-83.	1883-84.	Increase.	Decrease
IN CIVIL LIFE.												
Itinerant	758,047	792,784	34,737 (4·45)	—	59,947	59,494	—	9,453 (15·78)	817,994	843,278	25,284 (3·09)	—
Dispensary	28,770	29,986	1,216 (4·23)	—	2,435	2,525	90 (3·70)	—	31,205	32,511	1,306 (4·19)	—
Total	786,817	822,770	35,953 (4·57)	—	62,382	53,019	90 (0·14)	9,453 (15·15)	849,199	875,789	26,590 (3·13)	—
IN ARMY LIFE.												
Native Army	4,987	3,698	—	1,289 (25·85)	3,581	2,846	—	735 (20·52)	8,568	6,544	—	2,024 (23·63)
British Army	402	497	95 (23·63)	—	542	1,009	467 (86·16)	—	944	1,506	562 (59·53)	—
Total	5,389	4,195	95 (1·76)	1,289 (23·92)	4,123	3,855	467 (11·33)	735 (17·83)	9,512	8,050	562 (5·98)	2,024 (21·28)
Total for the whole Presidency.	792,206	826,965	36,048 (4·55)	1,289 (0·16)	66,505	56,874	557 (0·84)	10,188 (15·32)	858,711	883,839	27,152 (3·16)	2,024 (0·24)

It will be observed that there were 826,965 persons primarily vaccinated, and 56,874 re-vaccinated, against 792,206 and 66,505 in 1882–83, showing a net increase of 34,759, or 4·39 per cent., under primary vaccinations, and a net decrease of 9,631, or 14·48 per cent., under re-vaccinations. There was a considerable decrease (23·62 per cent.) under total operations amongst Native troops, the figures being 6,544 against 8,568 in the preceding year. The rate of increase in re-vaccinations was only 0·84 per cent., but it was very high amongst European troops, being 86·16 per cent. On the whole, there has been an increase of 25,128 or, in other words, for every 100 persons operated on in 1882–83 the numbers for this year have been 102·92.

Out of 826,965 persons primarily vaccinated, 791,323 cases were successful, or 95·69 per cent. or 0·46 per cent. below 1882–83. The number of unsuccessful cases were in excess of that in the preceding year, being 17,363 against 14,232. 2,433 persons were operated on a second time on account of the failure of the first operation, and in 20,712 cases the result is unknown, as the children were not again brought for inspection.

During the year, 56,874 persons were re-vaccinated against 66,505 for 1882–83. In 129 instances the re-vaccinations were repeated, in 6,289 instances the results could not be ascertained, and in 13,057 the operation failed. The number of successful cases was 37,657, or 66·21 per cent. against 69·80 in the preceding year.

The total number of persons operated on was 883,839, and of these 828,980, or 93·79 per cent., were successful. In 1882–83 the percentage was 94·11. There were 2,562 persons operated on more than once; the "unsuccessful" numbered 30,420, and the "unknown" cases were 27,001.

The age details are compiled for three periods, viz., under 1 year, between 1 and 6 years, and above 6 years. The number under each period primarily vaccinated were respectively 504,282, 298,582 and 24,101 against 485,661, 284,141 and 22,404 during the preceding year. The number of infants successfully vaccinated was 484,405, of children between 1 and 6 years 285,172, and of persons of other ages 21,746. Thus, out of every 100 persons primarily vaccinated, there were 60·98 infants, of whom 58·58 were successfully vaccinated. When compared with the preceding year, it is, however, lower by 0·57; but this is only apparent, because the difference between the numbers vaccinated and the successful cases is higher by 0·15 per cent.

The rate of protection was higher than last year in all the districts and circles, except in Cutch, Northern Deccan, Presidency Circle and Konkan. It was lowest in the Konkan and Presidency Circle. In British and Native territory it was respectively 30·57 and 31·49 against 29·89 and 29·46 per 1,000 of population in the previous year. On the whole, 30·89

persons of all ages per every 1,000 of population, against 29·74 last year, 27·54 in 1881–82, 24·60 in 1880–81, and 22·26 in 1879–80, were primarily vaccinated successfully.

Animal vaccination was carried on in Bombay, Poona City and Cantonment, Broach, and Kaira Collectorates and Rájkot and Dhrángadra. Much difficulty is experienced in obtaining heifers for inoculation. The Bombay method of advertising for a constant supply of heifers by contract was tried, but failed; consequently animal vaccination had to be stopped in the towns of Broach and Nadiád. Animal vaccination is popular among villagers, as it saves them the trouble of taking their children from village to village.

Except in Bombay, where animal lymph only is used, and in Poona, Broach, Nadiád, Anklesvar, Borsad, Rájkot and Dhrángadra, where both animal and human lymph were in use, vaccination in all other places was carried on from arm to arm and with human lymph. Vaccination with animal lymph was also carried on in Bándra. The total number of heifers inoculated was 935 against 645 last year; in 84 the virus did not take.

The total cost for the whole Presidency, including all charges, was Rs. 2,69,738.9.0, whilst the successful cases, excluding dispensaries and the army, amounted to 794,380. The average cost per each successful case was annas 5.5., or 2 pies less than last year.

There were 31 Inspectors and four Assistant Superintendents on travelling duty. Of this number 27 Inspectors and two Assistant Superintendents were paid by Government, and the remainder by Native States. The names of 364,063 children were called from the registers, of whom 276,212 were present, 87,853 were absent, but their absence was accounted for, whilst 98 could not be accounted for, as they had migrated. Out of 276,212 children inspected, 265,460, or 96·11 per cent., were protected, and in 10,752 cases, or 3·89 per cent., the operation was unsuccessful. Again out of 265,460, or 96·11 per cent. successful cases, 186,434 or 67·50 per 100 had "good" cicatrices, 51,604 or 18·68 "middling," and 27,422 or 9·93 "bad." In the registers tested, the results were entered as 341,904 successful, 12,705 unsuccessful, 10,176 unknown or absent, and 722 secondary operations. Excluding the unknown and secondary operations from calculation, to compare this result with that of inspection, the percentages of successful and unsuccessful cases are respectively 96·61 and 3·39. This shows that the results recorded by the vaccinators are approximately correct. The rate of travelling was quicker than last year in the Southern Deccan, Konkan, Eastern Gujarát, Sind and Baroda, and the number of villages seen was greater in Cutch and Baroda. The greatest number of villages seen was in Sind. The number of children inspected was greater in two districts and two circles—viz., the Northern and Southern Deccan, Cutch and Baroda.

Taking the work of all the Deputy Sanitary Commissioners, Superintendents, Assistant Superintendents, and Inspectors together, there were 4,417 encampments, 81,886 miles travelled in 8,136 days, and 360,271 children inspected in 12,989 villages. Out of every 100 persons operated on, 40·76 were this year inspected against 41·20 in the preceding year.

The Compulsory Vaccination Act (I. of 1877) has been in force for five years, and it is worked fairly well. The number of infants protected during the year was 12,331 against 14,940 in 1882–83. The decrease in 1883–84 is partly attributable to the large number of vaccinations owing to the prevalence of an epidemic of small-pox during the previous year.

This is the fourth complete year in which the Karáchi Vaccination Act (No. IV. of 1879) has been worked in that city, and a great improvement has been effected in the number of infants protected.

The Superintendent of Vaccination, Western Gujarát Circle, says that "revaccination has "made a great stride. This is entirely due to the fact that I take down all the names of "unprotected children requiring reprotection in every village and town I visit and give "them to the vaccinators. The parents then seldom refuse. I have also called upon the "Assistant Superintendents to act accordingly. To this I also attribute the large increase in "primary vaccinations."

He has also addressed a circular to the Political officers requesting them "to use their "influence with Native States to insist upon their dispensaries," which are 65 in number, "keeping up lymph so as to be able to give it to vaccinators on the appearance of an "epidemic near head-quarters."

The Chiefs of Káthiáwár have sanctioned the entertainment of a female vaccinator. An educated woman is now learning the art of vaccination, and when she has acquired that knowledge she will visit the courts of all the Chiefs.

Sanitary Works.

The actual outlay on sanitary works (military) during 1883 amounted to Rs. 1,74,733; of this sum Rs. 95,885 were expended at Jacobabad for constructing new Native Infantry lines. At Ahmedabad Rs. 34,580 were spent, of which Rs. 34,262 were for constructing Military works.

a hospital for British troops. At Nasirabad Rs. 21,338 were expended, of which Rs. 5,049 were for constructing new open drains in the Sadar Bázár, and Rs. 2,522 for renewing floors and cleaning walls of Royal Artillery stables. At Mhow Rs. 4,275 were spent, of which Rs. 699 were for excavating floor and removing soil of the sick horse stables of 17th Lancers, Rs. 861 on stable No. 16 occupied by A Troop 17th Lancers, and Rs. 1,528 were spent on stable No. 18 after a case of Loodhiana fever. At Poona Rs. 4,164 were spent, of which Rs. 2,097 were for converting the block of six cells into isolated wards for the station hospital, and Rs. 1,663 for preserving and watering trees that have been planted in connection with sanitary improvements to Ghorpuri Barracks.

Civil works.

The total annual income of the 163 municipalities during the year 1882–83 was Rs. 27,10,952, and the sum expended on conservancy by them was Rs. 11,48,903.

The details of the sanitary condition of the municipal towns given in the Sanitary Commissioners' Report are not reprinted.

ABSTRACT OF REPORT OF THE MADRAS MUNICIPALITY FOR 1884.

(*Mr. A. T. Arundel.*)

Drainage.

The pump and engine-house at Royapuram, the outfall channel with a masonry weir, and sewer No. 3 were practically completed during the year. The grant of the site of the engine-house &c., was confirmed to the municipality rent-free by the Government of India (G. O., No. 64 Revenue dated 16th January 1883). Sewer No. 3 is one of the main sewers of the new drainage system. It is 2,498 feet long and extends from the engine-house to the harbour intercepting sewer.

In connection with the general scheme, 11¼ miles of surface drains of various sizes were constructed. New house drains to the number of 314 were constructed by the owners themselves, and 21 by the municipality. A good deal more remains to be done in this direction. Advantage was taken of the works in progress to remove obstructive projections and encroachments in the streets, and to raise the level of many of the streets. Compensation had to be paid for removal of some of the old standing encroachments; but all these claims have been settled without serious difficulty or resort to law. The backyard floors of several houses which were below the level of the new drains have been raised. The total amount expended on drainage during the year was Rs. 1,64,351.0.10. In 1882 the amount spent was Rs. 78,921.7.5. The total expenditure up to end of 1883 was thus Rs. 2,43,272.8.3 out of an available sum of Rs. 4,00,000 raised by loan for the purpose. There remained a balance of Rs. 1,56,727.7.9 out of the loans for expenditure in 1884.

The diversion from the Coovum of the contents of the large sewer near Government House Bridge was nearly completed during the year. The engines and pumps were in course of erection when the year closed.

Water supply.

The extension of the water supply throughout Madras commenced in 1882 was completed during the year. Twenty-eight miles of pipes of various sizes, 170 valves, 463 hydrants, 178 fountains, and 27 silt traps were fixed. The cost of extension during 1883 was Rs. 1,65,436.9.3, which, together with the expenditure in 1882, made a total of Rs. 2,62,843.6.2 or Rs. 12,843.6.2 in excess of the loan raised in 1882 for the work. The balance was met out of the General Fund. Four miles of pipes, 31 fountains, 56 valves, and 24 silt traps, were fixed over and above the number contemplated in the original extension scheme. These extensions have naturally diminished the head of water available for general supply, and complaints are made that in some localities the house services are nearly useless. It is found moreover that some additional extensions are urgently necessary to a few outlying tracts still in need of water and also to erect additional fountains in localities only partially supplied. These additions must be considered in connection with a forthcoming scheme for an increase in the supply of water to the town and for its thorough purification by filtration.

The supply from the Red Hills Lake was maintained throughout the year, except on the 5th and 6th September 1883, when the supply to the 4th, 5th, 6th, 7th and 8th divisions was shut off to enable a 14" scour pipe to be fixed at the junction of Purasavakum High Road and Brick Kiln Road. During this time the town divisions were supplied from the Trevelyan Basin. The lowest level at which the lake stood was 36·21 in October 1883, when about 22½ inches of rain fell and raised the level. There were two slips in the Delivery Channel bund of a dangerous nature caused by the heavy rains; these were promptly repaired. The quantity of water drawn off from the lake into the Delivery Channel was 50,89,426 cubic yards for which Rs. 5,089.6.10, has to be paid to Government at the rate of R. 1 per 1,000 cubic yards. Proposals have been made to secure the conservancy of the shores of the Red Hills Lake, and powers have been inserted for this purpose in the new Municipal Act.

Conservancy.

In the removal of rubbish and filth 1,155 coolies, 586 carts, and 4 canal barges were employed; 363,328 cart loads were removed besides about 30,181 tons of night soil. The cost of hire of bullocks was Rs. 96,208.6.4. In the cleaning of main drains an expenditure of Rs. 7105.6.5 was incurred, but this sum includes arrear of 1882 on account of Black Town main drain.

Vaccination.

The expenditure on vaccination was Rs. 5,601.8.0 against Rs. 5,209.3.7 in 1882. The total number of cases vaccinated was 40,940 against 28,030 in 1882. The increase was

abnormal and was due to an unusually severe outbreak of small-pox which induced the people to resort to vaccination. The successful cases were 37,138, the unsuccessful 2,043, while 1,759 were not traced. The ratio of successful cases to the total vaccinated was 90·7 against 89·7 in 1882, and of unsuccessful cases 5·0 against 6·0 in 1882. The number of infants under one year vaccinated was 14,165 against 8,968 in 1882 or 88 children for every 100 born in 1883 against 54 in the previous year. The course of the epidemic will be traced in the report for 1884.

Health of Madras.

The birth-rate per 1,000 was 41·2 as compared with 42·7 in 1882, 40·3 in 1881, and 40·4 in 1880. The total number of births was 16,464 against 16,991 in 1882. The percentage of male births to female was 51·3 to 48·7. Of the births registered 395 were still-born, or for every 100 children born 97·6 represent "born alive" and 2·4 still-born.

The death-rate was 39·8 as compared with 35·6 in 1882, and 38·9 in 1881. The total number of deaths was 15,882 exceeding those of 1882 by 1,713. It is below the average of 10 previous years by 823. The cause was the prevalence of small-pox of a severe type.

The deaths were:—

	1882.	1883.	Increase.	Decrease.
Small-pox - - -	355	1,957	1,602	—
Measles - - - -	148	138	—	10
Fevers - - -	3,706	3,470	—	236
Cholera - - - -	461	169	—	292
Bowel complaints - -	2,110	2,284	174	—
Other diseases - - -	7,389	7,864	475	—
Total -	14,169	15,882	2,251	538

ABSTRACT OF REPORT OF THE MUNICIPAL COMMISSIONER FOR THE CITY OF BOMBAY FOR 1883—84.

(E. C. K. Ollivant, Municipal Commissioner.)

Water supply.

Of the works relating to water supply, those specially deserving of notice are the measures proposed and now in progress for increasing the quantity of water obtainable from the Vehar and Tulsi Lakes. When the Budget for the year under report was being considered, I addressed the Town Council on the subject with the result that the proposals then made were adopted, and that the Corporation upon the recommendation of the Town Council resolved on the 16th May 1883 that application should be made to Government for sanction to raise a loan of Rs. 20,88,000, by which provision was to be made for the works (amongst others) to which I now refer. The sanction of the Government of India to the proposed loan was communicated on the 18th January 1884.

Before the close of the financial year not only had the detailed surveys been completed, but considerable progress had been made with the catchwater channels, both at Vehar and Tulsi. The former promised to be effective for the ensuing season, the completion of the latter entailing rock and masonry work would, of necessity, require a longer period, but there is every reason to believe that they will be serviceable for the monsoon of 1885, by which time also it is to be hoped that the dams of the Tulsi Lake may be raised to the additional height proposed. The laying of the new main (for which a contract has recently been let) will occupy two seasons; but the half that is expected to be ready by April next (which will be connected with the existing main at Kurla) will confer an appreciable benefit in the next hot season. With reference to the Tulsi dams I may mention that the expediency of making the previous increase to the height (6 ft.) was well established by the experience of the present year, as the height of water in the lake on the 31st March was 6 ft. over the level of the old waste weir, and consequently not only was a larger supply available but the water was purer in quality—the draw-off being at a higher level than in any previous year.

The progress of work at the two reservoirs was not satisfactory, the completion of the contract work in both cases having been delayed long over contract time. The only work in hand at the Malabar Hill Reservoir was the construction of the filter beds, and these, though not ready for working within the year, were complete according to the design before the end of the hot season. The roofing—which will form the subject of a separate contract—has still to be done. The John Hay Grant Reservoir* at Bhandarwada Hill is now virtually complete, but it is very doubtful whether it can do full duty until the new main has been laid from Vehar. The work of laying the new mains (48″ and 32″) and making the several junctions in connection with this reservoir was attended with considerable difficulty, and the waterworks staff rendered excellent service in carrying it through.

The new main laid in Dungri Koli Street was much needed to give a better supply to that crowded section of the city, especially in cases of fire. During the year, 71,987 feet of old mains were examined by the waste water prevention staff, and wastage to the extent of 384,000 gallons per diem was discovered and rectified. I propose as soon as possible to introduce the Deacon Meter system for the prevention of waste, which has been found to answer so well in Liverpool, Glasgow, and other towns; and with the sanction of the Corporation, provision has already been made for the purpose in the loan already alluded to.

During the year, 437 new connections were granted, the total number now being 13,681; of properties so supplied, 12,737 pay by rate, 785 by meter, and 159 by special terms.

Drainage.

Very good progress was made during the year with the large intercepting sewer designed to carry the storm waters from Gowalia Tank and Khambala Hill to the old open main drain on the Flats. The rainfall of that neighbourhood will no longer contribute to the flooding of Khetwadi: the monsoon of 1883 showed that the measures already carried out in that neighbourhood (Khetwadi) had by the raising of low lands and the construction of three rain water sewers produced a marked beneficial effect. But though these local sewers and the large intercepting sewer already spoken of will do much to mitigate the long-standing evil, nothing like a complete remedy can be looked for (at times when a very

* In this reservoir the filtered water alone is roofed; in the Malabar Hill Reservoir the whole area of the reservoir is to be roofed, unfiltered water and filter beds included.

heavy rainfall happens to be coincident with neap tides) until the other large intercepting sewer to the east, and the storm water reservoir on the Flats have been completed. The completion of the latter sewer will still occupy another year. The waters from Pydhoni and districts eastward of the Parel Road being carried direct to the Flats will then no longer prevent the floods of Khetwadi from finding an exit in the direction of Falkland Road. There is nothing to delay the completion of the reservoir on the Flats save the diversion of the Tulsi Pipe Line. The greater part of the new main has been laid, and when the old main has been taken up, the reservoir work will be proceeded with. If funds allow, it will be desirable to make it at once of the size originally recommended by the consulting engineer (200 acres), instead of confining it to the 136 acres now contemplated. Measures should also be undertaken as soon as possible for the relief of the more suburban districts from floods, especially as buildings are being rapidly extended over ground which a few years ago was swamp or ricefield.

But in order to make any satisfactory arrangement for the disposal of storm water, at any rate from the more populous parts of the city, it is absolutely necessary that the disposal of sewage should not be ignored. The two things must be considered together. Local conditions render it impossible that a heavy fall of rain should be passed off rapidly when tides are high. It must therefore either be led to a temporary resting place where it will do as little harm as possible until it can obtain outlet to the sea, or it must be got rid of by pumping. The latter alternative was estimated by the late Mr. Ormiston at a cost that makes it prohibitive, the former alternative is the one which has been adopted. But it is very evident that the channel which conveys the rain water to the reservoir should not also be a carrier of sewage. Yet so it is, and this sewage pollutes the channel to an indescribable degree, and pollutes the Flats on to which the channel overflows and will pollute the reservoir (though not quite to the same extent, for periodical cleansing will be feasible). In past years there has been no help for this, but now that a thoroughly good sewage carrying sewer leading to the new pumping station has been constructed, there will be no excuse for allowing the intolerable nuisance to continue. Yet it must continue until all the sinks, gullies and cesspools of the city are connected with the new sewers instead of the old sewers which also carry rain water in the monsoon and discharge on to the Flats.

The new pumping station was fitted with its full complement of engines and has been found so far to answer admirably. The machinery is calculated to accommodate the whole of the sewage of that portion of the island to which the Report of the Drainage Commission of 1877 applied. The old pumping station with its outfall into the Love Grove channel was finally abandoned, and the municipality were after 14½ years freed from the liability of paying Rs. 300 per mensem on account of the nuisance caused by that outfall. The erection of a covered chamber and kiln for the disposal of the refuse collected at the point where the main sewer reaches the pumping station, is much needed.

The intercepting sewer (known as the Queen's Road sewer) designed to prevent the discharge of sewage into Back Bay was in course of construction the whole of the year. The early progress was good, but after the monsoon, when the work became more difficult, it was not satisfactory. So great was the sewage nuisance on Back Bay in the early part of 1883 that the Corporation offered a bonus of Rs. 10,000 if the contractor would in return undertake to complete the sewer by the commencement of the monsoon of 1884 instead of in February 1885, the contract time, and this he agreed to do. This agreement was entered into on the 1st February 1884. The month of March had hardly expired when the contractor threw up the work, and I had to make arrangements for carrying it out departmentally. This was done under the executive engineer, Mr. Walton, and the energy with which the work was brought to a conclusion by the end of June reflects the greatest credit upon him and the staff employed under him. In alluding to the completion of the work, I am, strictly speaking, going beyond the limits of the year under review, but this brief reference seemed to be desirable.

The new ovoid sewer in Clerk Road to the Six Roads Junction was completed, and a further extension to the Victoria Gardens was sanctioned and commenced before the close of the year. This main sewer will serve the branch sewers which are to be laid from the gas works and Parel on the one side, and from Byculla and Clare Road on the other. Provision for these works was made in the new loan already alluded to, and contracts were let in March. This district, in which fresh buildings are constantly springing up, has hitherto been undrained, and has been the subject of frequent complaints. Similar arrangements were made with regard to a new ovoid sewer from the Mint to the Crawford Market, by which the sewage of the Fort and of the southern portion of the Port Trust Estate, hitherto discharged into the harbour, will be conducted to the new pumping station at Love Grove. But, during the monsoon, the sewage of the Fort must, until separate branch sewers are provided for the segregation of sewage from storm water, continue as heretofore to find an

outlet into the harbour. So, too, on the western side of the city from the Secretariat to Chaupati, notwithstanding the Queen's Road intercepting sewer, the continuance of the numerous sewage outfalls into Back Bay is subject to the same conditions. Careful surveys were made of the sewerage of the Fort. The condition of most of the existing sewers is as bad as it can be, and plans were prepared for a complete new system estimated to cost Rs. 4,53,329. The execution of this work should not be delayed. Together with the sewerage of Nagpada, so repeatedly brought into prominent notice by the Health Officer, and of the districts immediately abutting on the Queen's Road, it merits the earliest possible consideration of the Corporation.

The pipe sewerage of Kamathipura was completed, and tenders were invited for the supply of iron materials for house connections there and in the first drainage section (comprising Market, Mandin, Umarkhari, and parts of Buleshwar, Khetwadi, and Girgan), and for the execution of the work of laying and fixing them. No tender for the work was received; subsequently one firm of contractors made an offer on terms too high to be entertained. For the supply of iron work for Kamathipura only a tender was eventually accepted on the 13th March 1884. The work will be proceeded with as soon as the materials are received. All other house connection work is in abeyance, pending the further sanction of the Corporation. I have had occasion to notice that much greater difficulties attend the use of syphons in this country than in England, and I have suggested the alternative course in certain cases of connecting the house gullies, instead of the individual houses, with the new sewers. The great object to achieve for the sanitary improvement of the city is to carry off polluted water or house sullage by means of the new sewers, and to do this it is absolutely necessary that a mode of ingress inaccessible to storm waters, or, in other words, above the ground level, should be secured. Until this is done, most of the new sewers are practically useless, and the evils, for the removal of which they were designed, continue unabated. Old house connections, where they exist in many parts of the city, are generally in a most deplorable condition, and so are the drains into which they discharge.

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ABSTRACT OF REPORT OF THE HEALTH OFFICER OF BOMBAY FOR 1883.

Public health.

During a considerable portion of the period under review, the health of the city was not good. There were 3,062 deaths more than in the previous year, and 931 more than the average of the previous five years. The gravity of this large increase is not lessened when we reflect that it was mainly due to the most prominent of what are termed preventible diseases, chiefly cholera and small-pox; but the mortality from fevers was 1,656 less than the average, it is right to mention.

Exclusive of still-born, 23,530 deaths were registered. The death-rate, estimating for increase of population, is equal to 29·12 per 1,000, as compared with 25·89 in 1882. The death-rate amongst a large permanent and non-fluctuating class of the population, the Parsis, is but 22·96.

In each of the four quarterly reports for the past year, I have brought forward, in the most urgent manner, the absolute necessity that exists for a permanent hospital for infectious diseases, and the municipal commissioner, in a letter published in the local newspapers, called attention to the want of an institution of this description. The necessity, however, for a permanent epidemic hospital must be so apparent to every one that it would be useless to add more on the subject. Now that this most important and pressing want has been brought again so prominently to their notice, there can be no doubt that the municipality will, without delay, sanction the necessary expenditure in order to provide this ordinary and necessary means of precaution for dealing with epidemic diseases.

Progress in sanitary work.

I would beg to draw attention to the extreme desirability of increasing the working establishment of this department. The scavenging branch is inadequate for the requirements of the city which cannot be kept in a completely clean, healthy, and sanitary condition without the increase which I have elsewhere asked for. The number of bullocks should be augmented. They are too few in number, and get quickly worn out, owing to their powers being overtaxed, thus entailing a pecuniary loss upon the municipality, while the work is not thoroughly done.

The question of the disposal of town sweepings has lately given rise to much discussion, but as it has been agreed to by all parties that under no circumstances will it be possible to continue to deposit cutchra on the Flats for any length of time, it is unnecessary to enter into any discussion in regard to that matter beyond expressing a decided opinion on my part that, under no circumstances whatever, should the present system of removing sweepings to the Flats be continued one day longer than is absolutely necessary. Some experiments have been made in burning cutchra, the results of which have only gone to strengthen the opinion previously entertained that this means of getting rid of the sweepings would, during the rains, prove a financial failure. The proposal to carry them out to sea would, during the monsoon, be attended with risk, so that the only other alternative seems to be to remove the cutchra to Kurla, and for this purpose I would again strongly advise that a tramway, which you have had under consideration for some years, should be constructed, which would in the end pay itself, and be the property of the municipality. Moreover, it will not be lost sight of that a large revenue would be realized from reclaimed land at Kurla. There would, no doubt, be some difficulty in obtaining suitable places for sidings. In certain parts of the town tanks might be filled in as originally recommended, by the Sanitary Commissioner, and used for this purpose. But whatever means of conveyance be adopted, the more the question of the disposal of cutchra is considered in all its bearings, the more desirable will its removal to Kurla appear to be. It is a simple, practicable, and, from a sanitary point of view, wholly unobjectionable solution of the difficulty.

In my Report for the 3rd quarter I have called attention to the fearful condition of the Port Trust property of Mody Bay in the following manner: "I cannot conclude this report without bringing to your notice the serious nuisance arising from the filthy condition of the foreshore at Mody Bay. To this place hundreds of people resort for natural purposes, and the night-soil is allowed to remain from week to week and month to month, without any adequate effort being made by the Port Trust to remove it. It is useless for the body to contend that there is sufficient excuse in the fact that latrines do not exist. They have not provided latrine or privy accommodation for a large number of their workmen and tenants, and until such time as they have complied with this requisition, which both decency and

health alike demand, they should be held legally responsible for the sanitary condition of their property. The breeze from the open sea sweeping over the putrefying night-soil carries infection and disease to the neighbouring European General Hospital, and many other buildings, inhabited both by Natives and Europeans. The nuisance has now reached such a pitch that it almost surpasses any other in Bombay, and immediate measures are therefore imperatively called for."

It seem preposterous that while lakhs of rupees are being spent for the removal of sewage, the Trust should permit masses of night-soil to accumulate and putrefy on the foreshore at Mody Bay, thus poisoning the air within a short distance of inhabited houses. It is absolutely necessary, in the interests of the public health, that active measures should be taken to induce the Port Trust to abate this nuisance.

The Back Bay nuisance, which had disappeared for some years, I believe, has been a source of grave anxiety during a few months of the past year, but I have already submitted a full and exhaustive report in regard to it, pointing out, amongst other things, that the Sonapur Main Drain, though one, is not the only cause of the nuisance. Every effort was made, and successfully, to mitigate it.

Much attention has been devoted to the condition of the Carnac Bandar Night-soil Depôt. The Tulsi water was at my suggestion turned on at this place, and affords generally an abundant supply with which to flush the tank. Before this, salt water and Vehar water were used for cleansing the depôt, but towards the end of 1883 the supply fell short and was not sufficient. Hoses have been provided, and new gratings made which, it is hoped, will admit of the night-soil being dropped direct through the hoppers into the tank without the intervening barrier of a grating to remove cutchra, such as rags, stones, &c. The nuisance, however, must continue to exist in a greater or less degree until such time as the night-soil is deposited elsewhere. Were a tramway constructed to convey the street sweepings out of the island, it would be a matter worthy of serious consideration whether the night-soil could not be removed by the same means.

It is a matter of congratulation, from a sanitary point of view, that the drainage of the city is being gradually, if not rapidly, proceeded with. Whether the whole of the sewage will ultimately be carried by the sewers, or whether the more highly scientific and sanitary mode of conveying by them only the sullage and subsoil water and of returning the night-soil to the land, be adopted, it is a matter for sincere congratulation that, it is to be hoped, at no very distant date the larger number of the 1,800 cesspools which are to be found scattered over Bombay will be done away with, and the disease producing subsoil water, in a measure, removed. When this has been accomplished, and a sufficient supply of wholesome drinking water provided, two of the chief causes of disease in this city will have been swept away. It is vain to hope that districts, damp and saturated with sullage which has no outlet, can be other than hot-beds of disease. It is most desirable, therefore, that the drainage system should be pushed on as quickly as possible, and every effort made to obtain a proper supply of pure drinking water for the city, and until this is done frequent epidemics of cholera and other diseases must be expected.

Vital statistics.

The mortality arranged according to groups of important death-causes is shown in the table which follows, except under measles and diseases of the respiratory system, from which there was a less mortality; there was an excess mortality from other causes over that of 1882. The death-rate from small-pox was 1·70, cholera 1·02, fevers 0·41, phthisis 0·44, diarrhœa 0·05, increased since 1882.

Causes of Death.	Number of Deaths.	Rate per 1,000 of Population.	Remarks.
Small-pox	1,461	1·81	
Measles	329	0·39	
Fever	5,903	7·31	
Cholera	1,027	1·27	
Phthisis	3,144	3·89	*Annual increment of population is calculated.
Diseases of nervous system	2,849	3·53	
Do. respiratory do.	3,394	4·20	
Diarrhœa	1,160	1·43	
Dysentery	646	0·80	
Accidents	357	0·44	
All other causes except still-born	3,270	4·05	
Total	23,530	29·12	

In 1883 we find that 10,087 children under 5 years of age died. The mortality per 1,000 of population in 1883 was 123·40, and in 1882 it was 108·99; the deaths of infants under 1 year of age in 1883 were 815 more than in 1882; the death-rate of infants under one year of age in 1883 was 290·73 per 1,000 to 254 per 1,000 in 1882. The deaths under 5 years of age were 42·46 per cent., and the deaths under 1 year 27·96 per cent. of the total deaths; in 1883 the deaths under 1 year of age were equal to 43·34 per cent. of the births. The deaths from fevers amongst children under 5 years of age were 435 more than in 1882.

Small-pox. The mortality from small-pox was very high, yet it was less than in 1876. There can be no doubt that as vaccination is more extended, and hygienic measures more carefully attended to, small-pox will, or at least ought to, become a disease of the past. But in order to protect Bombay from this scourge, it is not only necessary that vaccination should be rigidly carried out in the city itself, but also in the mofussil. A very large number of those attacked were strangers in Bombay, and in the ordinary course of things would not have been vaccinated here. A small-pox hospital is an absolute necessity, the want of which has been acutely felt in dealing with epidemics of this disease, and it is sincerely to be trusted that another year will not be permitted to pass without providing Bombay with such an institution. In all 1,461 deaths were registered from small-pox; 519 of the great number occured in March.

Cholera The cholera epidemic, properly so called, which had raged for several months from May to October 1883, had subsided, and in November there were only four deaths from the disease, and in December up to the 18th of the month six, when a sudden outbreak occurred almost coincident with the breaking of the Vehar main, which deprived Bombay of its larger source of supply of pure drinking water for three consecutive days. It has often been suggested that cholera is communicated or caused by impure drinking water, but in no instance that I know of has this surmise received more support than in the present instance. That the people, on being deprived of their ordinary supply of water, had recourse to impure wells and tanks, is undoubted. In many cases this has been clearly proved, and where the quantity of water was scantiest, there was cholera most virulent. On and in the neighbourhood of Navroji Hill, where sanitation was in the very worst state for this city, and the water supply least, cholera was most prevalent. The gullies, drains, cesspools and general surroundings of the houses were in a bad condition; many of the dwellings in which the disease broke out were badly ventilated, badly drained, and dangerously overcrowded, while imperfectly constructed, and uncleansed cesspools were to be found in various quarters. Near one house in C. Ward, where five cases occurred, the condition of the cesspools was truly appalling; they were so large and so constantly filled with a dilute solution of sewage that we, with our inadequate establishment, were unable to keep them clean. At some distance from those receptacles was a well of drinking water from which the supply for all domestic purposes was too surely drawn during the break in the Vehar water main.

With regard to Navroji Hill, the sanitary measures adopted were of a most energetic description. Extra carts were employed for removing cutchra, and additional biggaries and sweepers, under European Inspectors, entertained for properly cleansing this portion of the city. Every lane, gully, drain and privy throughout the hill was thoroughly cleansed, and the drains and gullies were freely flushed with a rough mixture of crude carbolic acid and lime. In every house in which cholera occurred the following and usual process was adopted: the floors of the rooms were dug up, and saturated with strong carbolic acid; the walls scraped and washed with phenyle, sulphur and dammer burnt in the rooms with closed doors for three days; the walls whitewashed at the expense of the municipality, the privies, drains, gullies, &c., cleansed and flushed with a mixture of carbolic acid and lime, while the privies themselves were whitewashed, and large fires with sulphur and dammer burnt in them and around the houses and along the streets. So convinced was I that impure water, consequent on the breaking of the Vehar main, was the cause of the outbreak, that at its commencement I expressed a decided opinion to that effect. I also expressed an opinion, which has been fully justified by subsequent effects, that as the outbreak in all probability was due to a local remediable cause, it would probably be of short duration and numerically not serious.

The character of the outbreak at its commencement was of a deadly type; the greater number of those attacked rapidly dying, and even in the J. J. Hospital and the Cholera Hospital at Grant Road, where everything practicable was done for the patients, the deaths largely preponderated over the recoveries. As time went on, however, the disease assumed a milder form, and recoveries were much more frequent.

The cases of cholera that came to my notice numbered 1,474, of which 1,027 terminated fatally; the mortality, therefore, was equal to 1·27 per 1,000 of population. Of these 1,474 persons 298 were born in Bombay, and 1,176 were born outside of Bombay. Of the cases

born in Bombay 188 died, and of the cases born outside of Bombay 839 died. 1,176 of those attacked are reported to have drunk Vehar and Tulsi waters, 828 dying; 198 are said to have drunk well-water, of which 142 died. In 100 cases we were unable to ascertain whether Vehar, Tulsi, or well-water was consumed; 57 of these cases proved fatal.

The greatest mortality from cholera was registered amongst Hindus, Hindu Low-Castes and Native Christians. The mortality from cholera amongst Europeans was 1·05 per 1,000 of population.

Examining the distribution of mortality from cholera over the city by districts, we observe that the highest mortalities were registered in Sewri, Mahim, Mazagon, Parel, and Warli. The high death-rate from cholera in Mazagon is not to be wondered at.

The pipe water-supply is insufficient and subject to interruptions, while the wells are liable to be constantly contaminated by percolation from adjoining cesspools, of which there are 174 in this small section, the contents of which saturate the ground, giving rise to that semi-fated humidity of soil which combined with impure water is so almost universally associated with cholera. Parel enjoys no advantages in regard to these particulars, and in certain portions of Mahim the water-supply during the recent epidemic was so notoriously bad that I had the wells shut up, and water was sent round in carts, which was followed by the most beneficial results. In Warli also the principal ostensible factors in the production of this disease were humidity of soil and an absence of a pure water-supply; so frequently, indeed almost constantly, are those two factors associated with outbreaks of cholera, that it is impossible to avoid arriving at the conclusion that they are the two principal causes or means of conveying the disease.

Fevers.

The number of deaths from fever was more than the number registered in 1882 by 456, and below the average of the previous five years by 1,656. Of the deaths from fevers, 1,439 were referred to remittent fever, being 251 more than in 1882, and 2,207 less than the quinquennial mean; to simple continued fever, 1,169 deaths were referred, being 242 more than 1882; and to ague 275, being 41 less than in 1882; to enteric fever 20 deaths were referred, being 2 less than in 1882.

The highest mortality from fever was registered in Parel, Kamathipura, Sewri, Warli, Mahim.

As in the year preceding, the Hindu Low-Castes suffered more from fevers than any other class, and the mortality was higher than in 1882, being 93 per 1,000. Contrasted with 1882, there was a diminution in the mortality from fevers amongst Europeans.

Other diseases.

Deaths referred to phthisis numbered 3,144, being 415 more than in 1882. The highest mortality occurred in Nal Bazar (Khara Talao), 2nd Nagpada, Chuckla, and Bhuleshwar, than in 1881 and 1882.

The number of deaths from phthisis was not greater than might be expected, considering the badly ventilated and fearfully overcrowded buildings in which a large number of the inhabitants of Bombay live. Much has been done by this department to improve the ventilation of dwelling-houses, but much still remains to be done. Until such time, however, as the Municipal Act is amended, and the by-laws passed, the municipality will remain in a measure paralysed in their efforts to improve the condition of dwelling-houses. It will hardly be credited, but the municipality have no power to compel an owner to improve the ventilation of his house, unless the required alterations can be carried out within twenty-four hours.

From diseases of the respiratory system 3,394 deaths were registered, 8 less than in 1882, but 673 more than the average; 1,828 were referred to bronchitis, 223 less than in the preceding year; 1,159 to pneumonia, 173 more than in 1882.

To diseases of the digestive system 2,371 deaths were referred, being 226 more than in the preceding year, but 466 less than the mean of the previous five years; 1,169—being 67 more than the past year and 56 more than the average of the previous five years—were referred to diarrhœa; and 646—being 121 more than in 1882 and 446 less than the mean of the previous five years—to dysentery; to all other diseases of the digestive system 565 deaths were ascribed, being 28 more than the past year, and 76 less than the mean of the previous five years.

From diseases of the nervous system 2,849 deaths were registered being 292 more than the average of the previous five years.

Births.

During the year 15,182 living births, and 1,449 still-born births, were registered; of the children born living 7,902 were males and 7,280 females; the proportion of male to female births was 108 to 100; the birth-rate was equal to 18·79 per 1,000. The highest birth-rate was registered among Eurasians, 67 per 1,000.

APPENDIX.

No. I.

MEMORANDUM of the ARMY SANITARY COMMISSION on the REPORT of the SANITARY COMMISSIONER with the GOVERNMENT of INDIA for 1883.

1. In dealing with this report, we shall follow the usual order, beginning with the sanitary history of British troops during 1883, which, for the sake of comparison with the history of preceding years, we have placed in the following abstract table, copied from Dr. Cuningham's Report:—

Years.	Strength.	Ratios per 1,000 Strength.				
		Admissions.	Daily Sick.	Deaths.	Invaliding.	Total Loss.
1870–79	573,446	1,475	60	19·34	45	62
1878	56,475	1,651	68	21·66	45	66
1879*	49,582	1,937	78	24·28	49½	73½
1880*	51,726	1,789	74	24·65	26½	51½
1881‡	52,728	2,095	79	16·86	38	55
1882	57,269	2,445	65	22·07	33½	45
1883	55,525	1,336	63	10·88	33	44

* Excluding troops serving in Afghanistan. † Including troops serving in Afghanistan.
‡ Calculated on the strength obtained from the annual returns.

This table shows that the year 1883 yielded the lowest death-rate for the Indian European Army of any year on record, and that there was a remarkable diminution in all the causes of inefficiency.

2. We shall next examine the facts more in detail, beginning with the ratios for each Presidency which were as follow for 1883:—

Armies.	Strength.	Ratio per 1,000 Strength.				
		Admissions.	Daily Sick.	Deaths.	Invaliding.	Total Loss.
Bengal	34,079	1,463	56	11·51	31	42
Madras	20,496	1,013	39	10·19	33	43
Bombay	10,948	1,249	57	10·50	38	48

The death-rates in the Madras and Bombay Armies have been nearly the same for the last year or two; but perhaps the most satisfactory data are those supplied by the Bengal Army, which shows a continuous reduction in the elements of inefficiency, except during the war years, which yielded an increase, as usually happens.

3. The next abstract gives the facts for the Bengal Army alone:—

Years.	Ratio per 1,000 Strength.				
	Admissions.	Daily Sick.	Deaths.	Invaliding.	Total Loss.
1870–79	1,522	61	21·00	41	62
1878	1,675	68	21·63	40	62
1879*	2,108	82	29·37	47½	77½
1880*	1,843	75	27·75	22½	50½
1881*	1,739	72	17·05	37½	54½
1882	1,579	69	18·17	25	43
1883	1,463	66	11·21	31	42

* Excluding troops in Afghanistan. † Including troops in Afghanistan.

The ratios in this Bengal table show clearly the influence of the Afghan war years. We have the declining rates before the war, then the increase consequent on the war, and finally the progressive reduction thereafter.

4. The data for the Madras Army are as follow. They bear marks, not of the Afghan war years, but of the epidemics which accompanied the famine:—

Years.	Ratio per 1,000 Strength.				
	Admissions.	Daily Sick.	Deaths.	Invaliding.	Total Loss.
1870-79	1,264	60	27·69	49	67
1878	1,392	66	21·82	48	70
1879	1,428	68	16·66	45	62
1880	1,368	64	10·18	20	30
1881	1,160	60	10·97	28	39
1882	1,058	57	10·25	24	34
1883	1,013	59	10·19	33	43

The reductions in this table are not so satisfactory, on account of the increase of invaliding in 1883; but the improvements in health and efficiency have been more steady, and the death-rate has remained low for a succession of years.

5. The next abstract gives the data for the Bombay Army, from which troops were detached for service in Afghanistan, and the influence of this occurrence is shown in the table:—

Years.	Ratio per 1,000 Strength.				
	Admissions.	Daily Sick.	Deaths.	Invaliding.	Total Loss.
1870-79	1,533	57	15·27	43	58
1878	1,848	67	20·46	58	78
1879	2,173	78	15·78	60	76
1880	2,150	76	30·90	49	80
1881*	1,784	72	13·44	53†	67†
1882	1,405	61	10·37	36	46
1883	1,249	57	10·50	38	48

* Excluding troops in Afghanistan. † Including troops in Afghanistan.

Estimated by the standard of attainable mortality under the operation and extension of sanitary improvement laid down by the Royal Commission for times of peace, these statistics for the armies of the Presidencies are satisfactory. But they also show to what an extent the general health of the army is under the influence of causes of sickness and mortality incident to field service, and quite apart from field casualties, and they clearly point out how great would be the advantage not only for efficiency in the field, but for the general standard of health, if disease causes on service were as far as practicable prevented or removed, as is being done at stations.

6. The statistical abstracts for Madras and Bombay show, with sufficient clearness, the course of sanitary improvement; but as the greater part of the army is stationed in the diverse regions which make up the Presidency of Bengal, we shall give the death-rates for the different army groups, to show where the reductions have taken place:—

Years.	Death-rates per 1,000 Strength.					
	Bengal Proper.	Gangetic Provinces and Oudh.	Meerut and Rohilcund.	Agra and Central India.	Punjab.	Hill Stations.
1860-69	29·57	28·59	26·61	38·48	25·24	14·78
1870-79	14·43	20·06	18·31	18·41	20·71	12·23
1880	16·03	29·32	22·98	15·07	36·41	20·75
1881	12·02	15·94	27·81	10·11	23·44	9·97
1882	11·19	22·61	8·86	10·51	18·12	8·65
1883	9·10	17·04	10·56	14·27	9·47	6·53

This abstract shows that sanitary improvement in all the groups of the Bengal Army, although subject to occasional interruption, has been continuous, and that to all appearance the very high rates of the earlier years have finally passed away.

7. In previous memoranda, we have stated the causes of the reduced death-rates, and we shall continue the data down to 1883, and in doing so, we shall restrict the comparisons to the more fatal

diseases of the epidemic group, namely, cholera and fever, as having the most important influence on the total mortality of the years :—

Years.	Ratio of Deaths per 1,000.								
	Bengal.			Madras.			Bombay.		
	Cholera.	Fevers.	All Causes.	Cholera.	Fevers.	All Causes.	Cholera.	Fevers.	All Causes.
1866–69	2·24	—	—	—	—	—	—	—	—
1870–79	4·16†	4·92	21·0	1·68	2·04	12·69	1·33	2·39	15·27
1880	4·84*	5·73	27·73	·16	1·75	10·18	—	3·99	30·90
1881*	3·22	3·45	17·05	1·73	·27	10·97	·80	3·74	15·44
1882	1·28	3·67	13·17	·82	2·36	10·25	·63	2·72	10·37
1883	·94	2·98	11·21	·95	3·14	10·19	·82	2·29	10·50

* Excluding troops in Afghanistan. † In this ratio are included 365 cholera deaths in Afghanistan.
The fever mortality for 1879 includes Afghanistan deaths, and from 1880–81 these deaths are excluded.

The first result of this table is, that it shows a large reduction of the total mortality, apart from the notable decline in cholera mortality. Fever has declined in Bengal, but it is a more persistent death cause in Madras and Bombay, more particularly at Madras stations. The facts taken as a whole appear to justify an expression of opinion, that improved health is due to sanitary work at the stations, and to better habits among the men, and improved administration generally.

8. We shall next discuss the disease history of 1883.

The average strength of the European Army was, as has been already stated, 55,525. The total admissions from all causes were 74,163, equal to an admission-rate of 1,335·7 per 1,000 strength. Of the admissions, 23,130 were due to fevers. The fever-rate per 1,000 strength was 416·5, and this disease group gave rise to 31 per cent. of the total admissions of the year. The diseases next in importance after fevers were those of the venereal group, which yielded 15,006 admissions, or 270·3 per 1,000 strength. Wounds and accidents followed next in order, with, 6,247 admissions, equal to a ratio of 112·5 per 1,000. Diseases of the respiratory organs, including 347 cases of phthisis pulmonalis, gave rise to 4,562 admissions, or 82·2 per 1,000. There were 290 cases of alcoholism and delirium tremens, 1,495 of dysentery, 2,573 of diarrhœa, and 1,602 of hepatitis. Rheumatism yielded 2,742 admissions. The disease usually considered the most formidable of epidemics, cholera, had only 82 cases admitted to hospital.

These data will afford sufficient indication of the main causes of inefficiency during the year for the Indian European Army as a whole.

9. The corresponding death statistics from the chief causes of mortality, were as follow: but in dealing with the data we shall give the totals only for the army as a whole, and then the deaths per 1,000 for each of the three armies :—

Causes of Death.	Army of India.		Death-rates per 1,000 Strength.		
	Total Deaths.	Deaths per 1,000.	Bengal.	Madras.	Bombay.
Cholera	51	·92	·94	·95	·82
Small pox	9	·16	·21	·10	·09
Enteric fever	133	2·40	2·52	2·86	1·55
Intermittent fever	3	·05	·03	—	·18
Remittent fever	20	·41	·41	·28	·55
Continued fever	3				
Apoplexy and sunstroke	61	1·10	1·32	·38	1·10
Delirium tremens, &c.	8	·14	·15	·10	·18
Dysentery	21	·38	·35	·28	·55
Diarrhœa	2	·04	·06	—	—
Hepatitis	63	1·13	1·06	1·72	·82
Respiratory diseases	37	·67	·57	·28	1·01
Heart diseases	17	·31	·32	·10	·46
Phthisis pulmonalis	38	·68	·79	·49	·55
All other causes	138	2·49	2·33	2·66	2·64
All causes	604	10·88	11·21	10·19	10·50

Out of the 604 deaths in this table, 21 were suicides, so that the total deaths from disease were 583, or 10½ per 1,000. Cholera occupied only a very subordinate position among the year's death causes, and the mortality from it was pretty nearly equalised all over the armies. The chief death cause was enteric fever, which was most fatal at Madras stations. As usually happens, Madras yielded the highest death-rate from hepatitis; and Bombay returned the highest rates from respiratory diseases and phthisis combined.

10. As we have discussed the death cause at stations of Madras and Bombay troops on other papers, we shall confine our remarks on the data furnished by this table chiefly to those relating to Bengal stations, and to the army as a whole, beginning with cholera.

During 1883, cholera gave rise to a death-rate of ·54 per 1,000 in the stations of Bengal proper, to 3·92 per 1,000 in those of the Gangetic provinces, to 1·25 per 1,000 in Agra and Central India, while Meerut and Rohilcund, Punjab, and the hill stations escaped the disease. The death-rate of ·54 per 1,000 in Bengal proper represents only a single death in Fort William, so that virtually the cholera of 1883 was confined to two military groups, the Gangetic provinces and Agra and Central India. In the former group, Dinapore yielded 7 deaths, Benares 1, Chunar 4, Lucknow 2, Cawnpore 1 death, and Allahabad 11 deaths; in all, 26 deaths for this group. In Agra and Central India cholera deaths, 5 in number, were returned from Gwalior fortress, so that only 8 stations out of 56 in Bengal Presidency were attacked. In Madras and Bombay, only 7 stations out of 39 suffered, and yielded 17 deaths. These did not include deaths on the march. The whole cholera mortality of the year thus took place at 15 stations out of 95, and more than half of the whole years mortality took place at six stations in the Gangetic provinces and Oudh, where 18,160 cholera deaths were registered among the civil population. In Allahabad district itself there were 598 cholera deaths registered, so that the 11 deaths among the troops were part of the epidemic.

11. *Enteric fever.*—We have already seen that this was the most fatal disease of the year. It gave rise to 429 admissions in the whole army, and of these 133, or 31 per cent. proved fatal. In the absence of this fever the year's death-rate would have been 3·43 per 1,000. Of these 133 deaths 86 took place at Bengal stations, and, unlike what took place with cholera, all the military groups, including hill stations and depôts, yielded deaths. The disease showed itself at 31 stations in Bengal Presidency, at 13 stations in Madras and Bombay. At the Punjab stations which escaped cholera there were 25 deaths from this fever, and in the Gangetic provinces, the stations which yielded 26 deaths from cholera, returned 21 deaths from enteric fever. The total deaths from all fevers in the Indian Army amounted to 159, or 2·86 per 1,000 strength, and of these deaths 133, or 83 per cent., were attributed to this fever. It may now be considered as a settled point in its history that, however much its diagnosis may be obscured by paroxysmal symptoms, it is in India a distinct fever. In the present Report it is shown that, for every case of enteric fever admitted in Bengal, 60 are admitted for other fevers, while in Madras 15 fever cases are admitted, and in Bombay 77. As regards the deaths, the statistics show that, out of a total fever death-rate of 2·86 per 1,000 for the whole army, all except 0·46 per 1,000, were due to enteric fever. We have so frequently discussed the numerous questions connected with this fever that it appears to be unnecessary to do more than to give a very brief abstract of the year's facts, as these are stated in the Report under review for the purpose of keeping up the continuity of its history.

12. The experience of medical officers during 1883 confirms that of previous years as to difficulties in diagnosis of this fever. There is absence of uniformity in the symptoms, and want of some of them in certain cases. The duration of cases is very various. At Umballa the average duration of favourable cases was 43 days. But one case ended fatally at the same station on the second day. At Morar a case ended fatally 36 hours after admission. A fatal case is mentioned in which the Peyerian patches were intact. The eruption is stated to be more frequently absent than present. Diarrhœa is said to be invariably absent until ulceration has set in. Pulmonary congestion "sets in early." A case is mentioned in which a careful and competent officer diagnosed a case as pneumonia which proved to be a virulent case of enteric fever, ending fatally in seven days. The previous appearance of paroxysmal symptoms, and of those of continued fever, often complicates the diagnosis, and hence the ratios of deaths to attacks vary greatly, and sometimes the term "enteric fever" is made to include all severe cases of fever. All these are well known difficulties in dealing with this fever in India, and they all enter as important elements into the question of diagnosis, but there can now be no doubt that enteric fever must henceforth be admitted as the most common of Indian fatal fevers.

13. Questions connected with liability to this fever presented the usual aspect. In 1883 the per-centage of men in the Indian Army under 25 was 41, and their enteric fever liability was 66·36 per cent. Between 25 and 29 years of age the per-centage of strength was 35, and the per-centage of liability was 22·94. Of men of 30 years of age and upwards the per-centage of strength was 24, and the per-centage of liability was 10·70, but no fatal case appears to have occurred after the age of 34.

As regards the influence of length of service in India on the mortality of enteric fever the facts in 1883 were as follows. The per-centage of men who had served for two years and under was 32·3, and their per-centage of liability was 70·32. Of men with five years' service and under the per-centage was 74·2, and the per-centage of liability between the third and sixth years was 21·89. Of men with seven years' service and under the per-centage was 85·5 But no separate liability ratio is given. It appears that in 1883 only 14·5 per cent. of the troops had served longer than seven years, and the per-centage of liability among this group had been 7·7 It follows from these data that we now know that enteric fever is the fatal fever of India, and that it is most fatal at ages under 25, and in the first two years of Indian service.

14. If there are difficulties in the diagnosis of enteric fever there are also difficulties in arriving at its local etiology. So far as concerns the subject, the soldier, the data accumulated during past years all point in the same direction. Whatever may be the local etiology of enteric fever, the relation of this fever to age is now established, and of course the sanitary conclusion is to endeavour to send older soldiers to India.

As regards the local etiology, Dr. Cuningham states that "no positive results of any value have "been arrived at." But there are nevertheless certain facts stated by medical officers which are very much in accordance with facts connected with enteric fever in Europe.

For example, one medical officer states that foul tank water used for wetting tatties frequently "emitted a most offensive and putrid odour." This case may be referred to, because it is by no means unlikely that this method of cooling air by passing it over wetted decomposable material is an unsafe practice in a hot climate. In another case dirt from cows' udders getting into the milk is stated as a probable cause. Bad water and the drying up in summer of foul tank surface is also suggested.

The facts connected with local outbreaks appear to point to general causes. Thus, at Lucknow, there was an outbreak, and 44 cases took place in regard to which the medical officer says that, "even in the barracks occupied by the regiment which supplied most of the cases, there was no "marked prevalence in any building or locality."

A similar remark is made about the cases at Jubbulpore and Cherat. No transference of the disease by infection was observed.

It would have helped us to a solution of the etiological question if we had been informed of the steps which had been taken to improve the drainage, water-supply, and conservancy of Lucknow where the 44 cases of enteric fever took place, for it is certain that in older reports there were causes described sufficient to account for any number of enteric fever cases. There is nothing in the present Report to lessen the importance we have all along assigned to local defects, such as those stated above, in the chain of events. The practical result is that, without losing time in trying to assign its special importance to every local cause, which moreover we have no means of doing, we are fully justified in advising that these enteric fever stations should be continuously improved, especially by drainage of the subsoil, where in all probability the real evil exists.

15. Enteric fever is what may be called a constant quantity in Indian Army death-rates, as the following abstract shows. It does not come and go like cholera. It is liable to temporary periodic increase and decrease, but it is always there doing doing its deadly work.

Annual Admissions and Deaths per 1,000 from Enteric Fever.

Years.	Bengal.		Madras.		Bombay.	
	Admissions.	Death.	Admissions.	Deaths.	Admissions.	Deaths.
1878-79*	5·5	2·28	3·9	1·42	3·1	1·55
1880†	3·7	1·97	2·6	1·36	2·5	5·76
1881†	6·3	2·62	0·9	·58	4·2	2·83
1882	7·8	2·90	4·0	2·09	5·4	1·90
1883	8·1	2·52	3·6	2·86	5·7	1·55

* Including troops on active service, and on march. † Excluding troops in Afghanistan.

16. *Dysentery.*—The following abstract gives the statistical history of dysentery for the whole Indian Army, as well as for those of the Presidencies:—

Years.	Ratios per 1,000 Strength.							
	Army of India.		Bengal.		Madras.		Bombay.	
	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.
1860-69	‡	—	49	2·72	‡	—	‡	—
1870-79*	40	1·48	33	1·37	77	2·32	28	·98
1880	54	2·96	49†	2·72	46	·58	56	4·14
1881†	32*	1·72*	29	1·00	37	1·15	23	1·82
1882	29	·57	27	·77	50	·36	14	·18
1883	27	·38	23	·35	49	·28	18	·55

* Including troops on active service, and on march. † Excluding troops in Afghanistan.
‡ Statistics incomplete at the Commissariat's Office.

This table shows a remarkable reduction in the prevalence of dysentery all over India. It also shows a progressive diminution of its fatality. The disease and its treatment are better understood, and part of the lower death-rate is probably due to this cause. But the actual amount of the disease has undergone a great diminution, as sanitary work has made progress at the stations, especially in water-supply. And the facts as they stand may also lead us to the conclusion that the soldiers' personal habits have been undergoing improvement. We have no means of knowing to what extent improvements in night ventilation to prevent chills may have been introduced, but as exposure at night to hurtful air currents has been assigned by competent medical officers as one cause of dysenteric attacks, and as the disease still gives rise to a notable death-rate (there were 21 deaths from it in 1883), it may not be out of place to recall attention to this detail.

17. *Diarrhœa.*—Deaths classed under this head are not among the chief death causes in the Indian Army, but it is satisfactory to know that a marked reduction has taken place in their

prevalence. During the ten years' period 1870–79, the diarrhœal death-rate was 0·12 per 1,000. In 1880 it was 1·32. In 1881 the rate was 0·32. In 1882 it had fallen to 0·07, and in 1883 to 0·04, per 1,000.

18. *Hepatitis.*—The next abstract shows that diseases of the liver have also declined in severity, except in the Madras Army, where they have been generally more prevalent than in those of the other Presidencies:—

Years.	Death-ratios per 1,000 strength.			
	Army of India.	Bengal.	Madras.	Bombay.
1860–69	—	3·34	—	—
1870–79*	2·19	2·04	3·16	1·71
1880	1·34	1·36†	1·26	1·31
1881†	1·60*	1·64	1·54	1·52
1882	1·40	1·48	1·72	·81
1883	1·13	1·06	1·72	·82

* Including troops on active service, and on the march. † Excluding troops in Afghanistan.

19. *Sunstroke* and *apoplexy*, the deaths from which are to a large extent climatic, cannot be expected to show steady reduction in amount even when the general health of the army may be improving. For the whole Indian Army these affections yielded an average death-rate for the ten years' period 1870–79 of 1·52 per 1,000. In 1880 the rate had increased to 2·69 per 1,000, chiefly in Bengal. In 1881 the rate had again fallen to 1·43 per 1,000 and to 0·85 per 1,000 in 1882, to be followed by a rise to 1·19 per 1,000 in 1883. From what we know of the soldiers' habits, it may be safely predicted that mortality under this head ought not to be altogether attributed to the sun. Some of it, at least, is due to intemperate habits, especially to the use of spiritnous liquors.

20. *Respiratory diseases.*—There has been a marked reduction in deaths under this head in all the armies, subject, however, to occasional augmentations. The whole army yielded a death-rate from chest affections of 0·97 per 1,000 during the years 1870–79. In 1880 the rate was 2·93 per 1,000, which has declined during the three subsequent years to 1·76, 1·75, and 0·67 per 1,000.

21. *Venereal diseases.*—The present Report contains full details of the year's experience of these diseases in all the armies. It is unnecessary to discuss the subject, as all the past experience shows that none of the methods hitherto adopted for dealing with them appear to have made any material impression on their amount. The authorities in India are fully alive to the questions which have arisen in regard to them, and all we think it necessary to do is to state the facts, which show exactly the point at which we have arrived in our attempts at prevention by lock hospitals, registration, and police measures. They have been as follows:—

Armies.	Venereal Admissions per 1,000.					
	1860–69.	1870–79.	1880.	1881.	1882.	1883.
Bengal	265	209	276	276	272	281
Madras	—	198	275	258	288	289
Bombay	—	191	269	261	224	238
India	—	203	250	240	265	270

These are the main facts, but, of course, the exact amount of injury to efficiency which venereal diseases give rise to depends in its degree on the nature and severity of the cases. During 14 years Dr. Cuningham gives the admissions at unprotected stations as 227 per 1,000, and for protected stations at 223·1 per 1,000. The only hopeful matter about the case is that the improvement was due entirely to Bombay stations, at which the protected stations yielded an admission-rate of 200·7 and the unprotected stations of 240·7 per 1,000 during these years. Cannot the Bombay methods be tried elsewhere? Some saving might possibly be effected, but, with the experience shown in the abstract, there is scarcely much to be hoped from them.

22. *Invaliding.*—Any attempt at estimating advances in army health must necessarily be unreliable, unless the extent to which the removal from India of broken constitutions has influenced the local death-rates is taken into account. The deaths from all causes in 1883 numbered 604, and 702 men were invalided for discharge from the service. If these men had been retained in India, it is very probable that some of them would have been added to the mortality loss of the year. But besides these invalids, who must be considered as absolute loss to the army, there were 1,073 men sent away for change, among whom, no doubt, there were weakly men near the end of their term of service. It usually happens that a proportion of this class is restored to health on the voyage, and many rejoin their depôts on arrival at home.

The annual number of invalids of both classes is contingent on the general health standard of the Indian Army at the time, and this is influenced not only by locality and by conditions of Indian service, but also by the constitution and periods of service of regiments. And hence it is not easy to state what amount of influence on the death rates in India is really exerted by invaliding, especially as in times past there have been differences in practice in this matter in the Presidencies.

In 1883 the proportion of men invalided for discharge was 39 per cent. of the total invalids, against 35 per cent. in 1881, and 37 per cent. in 1882 for the whole Indian European Army. But the proportions varied between 21 per cent. in Bombay and 45 per cent. in Bengal. Yet even in this case it cannot be predicated that Bengal kept down its death-rate by its high proportion of invalids for discharge, unless the actual rate per 1,000 of total invalids had also risen.

23. Perhaps, on the whole, the smallest extent of error in forming an estimate of the actual sanitary progress of the Indian Armies will be simply to quote Dr. Cuningham's table, in which the chief elements of inefficiency in each army are placed in parallel columns as follows :—

Years.	Ratio per 1,000 Strength.								
	Bengal.			Madras.			Bombay.		
	Admissions.	Deaths.	Invalids.	Admissions.	Deaths.	Invalids.	Admissions.	Deaths.	Invalids.
1870	1,732	22·68	59·42	1,456	20·94	78·93	2,563	26·27	29·17
1871	1,508	17·83	44·54	1,193	20·10	45·32	1,518	14·02	30·54
1872	1,514	27·45	43·18	1,357	18·98	35·27	1,588	18·86	40·62
1873	1,350	15·40	37·75	1,271	18·29	32·57	1,816	11·72	41·66
1874	1,444	14·63	38·24	1,144	12·96	32·53	1,286	10·64	35·88
1875	1,387	17·32	38·71	1,110	14·85	45·05	1,404	26·92	40·56
1876	1,448	16·02	35·86	1,134	15·27	41·53	1,317	12·39	46·83
1877	1,251	11·64	39·68	1,178	18·85	47·47	1,366	12·09	48·04
1878	1,675	21·63	40·54	1,392	21·82	47·24	1,848	20·46	57·65
1879	1,918	44·15	46·70	1,428	16·66	45·02	2,178	15·78	60·11
1880	1,813*	27·73	22·25	1,368	10·18	20·17	2,150	30·90	48·27
1881*	1,729	17·05	36·92†	1,160	10·92	27·91	1,784	13·44	53·35†
1882	1,572	13·17	34·26	1,668	10·25	24·12	1,495	10·37	35·85
1883	1,463	11·21	30·89	1,013	10·19	32·70	1,249	10·50	38·08

* Excluding troops in Afghanistan. † Including troops in Afghanistan.

This table contains the data on which our view of the health of each Presidency Army and its causes must be based. It shows the variations in individual years common to all vital statistics, especially to those of an epidemic country. But the data taken as a whole show :—

(1.) That in Bengal Presidency, where above half the whole European Army is in cantonments (34,079 in 1883), there has been a reduction in the admission-rates, interrupted in individual years, but the general tendency has been downwards; that there has been a large reduction in the death-rates, increased, however, for the time by men who had returned to Indian stations from Afghanistan, and that these reductions have not been attended by increase of invaliding, but, on the contrary, by reduction in this element.

(2.) That Madras Army shows an irregular reduction in the admission-rate, and an almost continuous reduction in the death-rate, with a large corresponding diminution of invaliding.

(3.) That admissions have undergone irregular reductions in the Bombay Army, part of which was engaged in Afghanistan, and suffered in consequence on returning home. That, with occasional interruptions due to this cause and to epidemics, the death-rate has declined and continues low, but that, although the amount of invaliding in the Bombay Army has been large, there is no evidence in the table that it has been used to keep down death-rates, or has had any such effect. Indeed, it follows as a matter of course, that, if the medical administration in this matter be uniform, and if the health of the army is undergoing improvement, there ought, with a diminishing death-rate, to be a diminishing admission-rate, at least from local disease causes, and also a reduction in the invaliding, and this is the teaching of this table. There is no evading the result of the facts as a whole, that the health of the European Army in India has undergone remarkable improvement since the Royal Commission of 1859 began its inquiry, and there is every reason to accept its conclusion, that a death-rate of 10 per 1,000 ought to be the death-rate of the Indian Army in time of peace.

24. The experience of newly arrived regiments in 1883 was as follows. The strength was 1,453. The admission-rate was 1,737·8 per 1,000. The daily sick-rate was 82·6 and the death-rate 19·96 per 1,000, or not far from double the rate for the whole army. Of this high death-rate 8·95 was due to one disease, enteric fever, which caused the entire fever death-rate. As already stated, the enteric fever death-rate for the whole army was 2·40 per 1,000. It is clear that large arrivals of men new to Indian service must exercise a notable influence on the death-rates, and hence, when there are few new regiments sent out, the general army rate will be lower than it would be otherwise.

25. *Soldiers' wives and children.*—The numbers under this head have been steadily decreasing. In 1883 there were 3,290 women and 6,015 children at the stations. The death-rate among the former was 21·28 per 1,000, of which 3·65 was due to child-birth and abortion. Deducting this from the general rate, the deaths from disease would be 17·63 per 1,000. The total death-rate among women has been declining with improved health. Children's death-rates have also notably decreased. Within the last few years they have been as high as 7½ per cent., or even higher, while in 1883 they were 46·88 per 1,000. The greater part of the mortality was due to infantile diseases.

26. *Mortality of officers.*—In 1883 there were 2,900 officers in the British Army and 3,215 in the Native Army in India. In both services combined there were 75 deaths, or a ratio of 12·2 per 1,000. In 1881 the death-rate of officers was 15·67 per 1,000, and in 1882 the death-rate was 12·16 per 1,000. Hence the death-rates have been falling throughout the whole army.

27. *Native Army of India.*—The strength of the Native Army in 1883 was 114,830, and the various inefficiency rates stood as follows:—

	Per 1,000.
Admissions to hospital	923
Daily sick	31
Deaths in hospital	11·76
Mortality, including absent deaths	14·31

The admissions and daily sick-rates were the lowest during seven years, and with the single exception of 1877, the death-rate was the lowest in the series.

The following were the inefficiency rates for the Native Armies of each Presidency:—

Armies.	Ratio per 1,000 Strength.		
	Admissions to Hospital.	Daily Sick.	Deaths, including absent Deaths.
Bengal	985	32	13·98
Madras	737	27	12·51
Bombay	994	35	14·96

The hospital death-rates were lower, of course, than those in this abstract, and were for Bengal 10·55, for Madras 10·76, and for Bombay 12·81 per 1,000.

The differences are due to the Native practice of preferring, in many cases, to return to their homes when seriously ill.

28. The Native regular Army all over India, like the European Army, shows improved and improving health, but the progress in the former army has not been so rapid as in the latter. Still the improvement in health is common to the whole military forces of India.

In the other Native Army groups the year's statistics give the following results:—

Forces.	Ratios per 1,000 Strength.			
	Admissions.	Daily Sick.	Deaths in Hospital.	All Deaths.
Central India Regiments	595	19	7·89	10·16
Punjab Frontier Field Force	1,419	45	21·46	23·35
Hyderabad Contingent	572	20	7·59	9·31

29. We shall conclude this brief sketch of the sanitary state of the European and Native Armies in India by comparing certain elements of inefficiency which the statistics present.

The total admissions among European troops amounted to 1,335·7 per 1,000, and among Native troops to 923·5 per 1,000. The excess among European troops was 412·2 per 1,000, partly accounted for by admissions for venereal diseases, which were 270·3 per 1,000; while among Native troops the corresponding admissions were 31·6 per 1,000. We can thus strike off from the 412·2 per 1,000 about 238·7 per 1,000, which leaves a balance of 173·5 from other diseases against British regiments. Fevers of all classes occasioned 387·6 per 1,000 admissions in Native regiments against 416·5 in British regiments. The excess was mostly made up of the severer fever types, but the admissions from intermittent fever, which amounted to 359·3 in British regiments, were 377·1 in Native regiments. This is what usually happens.

30. As regards the death-rates, the following facts are of interest:—

Death Causes.	Ratios per 1,000.	
	British Regiments.	Native Regiments.
Cholera	·92	1·15
Enteric fever	2·40	1·41
Intermittent	·05	
Remittent and continued	·41	
Apoplexy and delirium tremens	1·24	·21
Dysentery	·38	·46
Diarrhœa	·04	·37
Hepatitis	1·13	·18
Respiratory diseases	·67	3·91
Phthisis pulmonalis	·68	·70
Dropsy	·04	·23
Anæmia and debility	·02	·43
Scurvy	·09	·14

It will be seen that in 1883, at least, the balance of cholera mortality had been turned against the Native regiments instead of against the European troops, as was formerly the case. But it is otherwise with the fever death-rate, which was 2·86 per 1,000 in European regiments, or above double the rate, 1·41 per 1,000, among Native troops. But of the European excess all but ·46 per 1,000 was due to enteric fever. It would be quite safe to attribute the 1 per 1,000 death-rate from apoplexy, delirium tremens, &c., in the British regiments to drink. The table shows that Native troops suffer more from dysentery and diarrhœa than British troops. But the mortality from hepatitis, partly due likewise to drink, is nearly sevenfold greater among British than among Natives, phthisis pulmonalis is most fatal among Natives, but the most striking difference between the two armies lies in the nearly sixfold mortality from respiratory diseases in the Native regiments.

The death-rates from dropsy, anæmia, and scurvy are all higher in the Native regiments, in the ratio of ·8 per 1,000 to ·15 per 1,000 in the European Army.

So far as can be estimated from one year's returns, the health of the Native Army would be improved by better housing, clothing, and feeding, while the European Army would improve its health by giving up spirit drinking, and pressing forwards the sanitary improvement of stations, especially in the matter of drainage, and in the general care of the health of young soldiers, so long as the strength in India has to be kept up at young ages.

31. So far as relates to the sanitary improvement of British stations, the chief lesson taught by the year's statistics is that effort should be strenuously directed towards the drainage and general improvement of enteric fever stations. These are all known, and are duly set forth in Tables 22 and 24 of the present Report. The chief offenders are the stations in the North-West Provinces and Oudh, such as Dinapore, Fyzabad, Lucknow, and Sitapur; and Secunderabad and Kamptee in Madras. In making this recommendation we are only repeating what we have urged year after year.

32. No better guide to the disease causes at Native stations could be desired than is contained in an abstract of returns from Native stations given in the body of the Report.

With the facts stated in this document we can only express surprise that the Native Army suffers so little as it does. There are no corresponding data for the lines of British troops, but the general defects in sanitary details, apart from the special defects in Native lines, set forth in the returns are by themselves quite sufficient to point to the local fever causes which form so prominent an element in the inefficiency and mortality of British regiments at the same stations.

Jails in India.—The average population of all the jails in India during 1883 was 88,174. The following abstracts include the chief statistical data bearing on the health of prisoners during the year:—

Total admissions to hospitals	87,797 = 995·7	per 1,000 strength.
Daily sick	3,220 = 36·5	
Deaths	2,766 = 31·37	

It may be safely stated that the death-rate of 31·7 per 1,000 is not a high rate when compared with the probable death-rate of the outside population, and as will be seen from the next abstract, the rates as a whole are the lowest on record.

Years.	Strength.	Ratios per 1,000 Strength.		
		Admissions to Hospital.	Daily Sick.	Deaths.
1872-76	99,758	1,016	?	36·24
1877-81	112,670	1,189	44·9	63·01
1880	106,763	1,213	46·0	48·31
1881	100,844	1,214	45·8	44·33
1882	94,063	1,214	42·0	39·96
1883	88,174	996	36·0	31·37

* The years of greatest mortality in this abstract are those of the famine period following 1876. In those years there was a great influx of half-starved people, many of whom committed crimes for the

purpose of being fed in prison. The consequence was great overcrowding and its attendant conditions, and great mortality. When the disease and death rates are compared with the strength of each year, there is an evident relation between the two, and the conclusion from the facts would hence appear to be that, given the present extent of prison accommodation and its present sanitary arrangements, the admission and death-rates are to a certain extent dependent on the average occupation, and hence that crowding is an efficient disease and death cause in Indian jails.

This inference is, moreover, sustained by the sanitary notes contained in the reports for 254 jails, which show in many cases that overcrowding was one of the disease causes alleged by medical officers as having been more or less present during the year.

34. A further analysis of the data shows that rates were by no means uniform, but differed greatly in different jail groups, as stated in the following abstract for 1883 :—

Districts.	Ratios per 1,000 Strength.		
	Admissions to Hospital.	Daily Sick-rate.	Deaths.
Bombay Presidency	733·7	26·9	34·33
Berar	558·5	14·2	8·49
Madras Presidency	861·2	32·1	29·87
British Burma	1,158·7	38·8	28·94
Andamans	1,454·0	67·0	19·63
Assam	2,125·2	56·4	43·12
East and North Bengal	1,504·8	50·6	64·78
South West Bengal and Chota Nagpore	1,299·6	49·3	69·87
Behar	1,124·5	41·0	33·9
North-West Provinces and Oudh	408·0	16·9	10·28
Excluding Oudh	611·9	25·0	22·79
Central Provinces	219·2	35·6	70·97
Punjab	951·0	26·9	29·11

These data show how very different are the sick and death-rates in different groups of jails. It is true that the facts only apply to a single year, but they are quite sufficient to justify a recommendation that the whole subject of current comparative death rates and the causes of their differences should be inquired into. It need scarcely be stated that these local facts detract considerably from the favourable impression produced by the year's statistics when taken over the whole prison population.

Death-rates in individual jails differ just as widely or more so than they do in jail districts. There is one jail in the list, Rungpore, with 240 prisoners, which returns of death-rate of 183·33 per 1,000, in the entire absence of cholera. In another case, Julpaiguri, 118 prisoners yielded a death-rate of 162·39 from cholera and 136·76 per 1,000 from other causes, so that this jail lost 30 per cent. of its inmates during the year. Midnapore jail, out of 797 prisoners, had a death-rate of 102·89 per 1,000, of which only 1·25 was due to cholera. Among 607 inmates in Gorakpur jail the death-rate from cholera was 62·60, and from all other causes 84·02 per 1,000.

We have often adduced facts of this class. They are indeed well known, and their lesson is that the way to make the most immediate impression on these jail rates is to take such extreme cases in hand, to trace the causes wherever they may be, and to deal with them.

It is right to state that the present year's Report contains fewer of these anomalous high rates than the Reports of many previous years, and we are glad to state that Coimbatore district jail, which was a great offender in this respect, had a death-rate in 1883 of no more than 21·28 per 1,000; even lower than the Central jail, which was 28·35 per 1,000.

35. *Death Causes in Jails.* We have already seen that the average death-rate taken over the entire prison population of 88,174 was 31·37 per 1,000, representing 2,766 deaths from all causes during the year. As diagnosis in prisons is in all probability not far from the truth, it will be useful while giving the death ratios to introduce the admissions from the chief diseases as follows :—

Diseases.	Admissions to Hospitals.	Total Deaths.	Ratio per 1,000 Strength.	
			Admissions.	Deaths.
Cholera	351	201	4·0	2·28
Small-pox	105	10	1·2	·11
Fevers, enteric	15	2	·2	
„ intermittent	31,008	61	351·7	2·32
„ remittent and continued	1,516	153	18·3	
Dysentery	7,013	455	79·5	10·64
Diarrhœa	7,499	483	85·0	
Apoplexy	101	51	1·1	·58
Hepatitis	87	19	1·0	·22
Spleen diseases	591	23	6·7	·26
Respiratory diseases	4,232	467	48·0	5·30
Phthisis pulmonalis	502	196	5·7	2·22
Anæmia and debility	2,421	100	27·5	1·81
Scurvy	315	15	3·6	1·5
All causes	87,707	2,766	995·7	31·37

This table shows that about a third of the whole year's mortality was due to diarrhœa and dysentery, and not far from a fourth part arose from respiratory diseases and phthisis. Cholera was a subsidiary death cause only. Out of these 87,707 admissions which were diagnosed by professional observers, this abstract shows that 37 per cent. arose from fevers, but the actual fever mortality was only 8 per cent. of the total mortality. This patent fact helps us to estimate the value of the high fever-rates returned from among the civil population, as does also this other fact that the actual fever mortality among the prison population scattered all over India was only 2·32 per 1,000 of that population, instead of 8, 10, 15, 20, or 25 per 1,000, rates which are not unfrequently met with in district tables. The death causes which point specially to the need of remedy are those of dysentery and diarrhœa. In some of the reports these are attributed to dietetic defects, but cold and night chills may also act as causes, and way the subject should be inquired into and remedial measures applied. While making this recommendation we can at the same time fully acknowledge the generally improved sanitary state of Indian prisons as a whole shown by the statistics of 1883.

36. *General population.*—In our Memorandum of Dr. Cuningham's Report for 1882 we give the details of vital statistics for all the Governments of India, and we shall merely give the general results as affording sufficient data for the year 1883.

The population for the whole of India, including the Native States, on the census of 1881, was 253,891,821. This vast aggregate was made up of 129,941,851 males and 123,949,970 females, inhabiting 1,272,588 square miles of country in the ratio of 185 persons per square mile. The whole population was distributed among 714,707 villages, scattered over the area at the rate of 52 towns and villages to every 100 square miles of area.

The whole of this population is not, however, under registration of births and deaths. In 1883 deaths were returned from among a population of 197,614,787, living within 4,676 registration circles. But in Bengal, with its population of 66,168,884, births are registered only in 46 municipalities and towns, having a population of 1,685,159, under the impression that a more reliable birth-rate could thus be obtained, and so estimated for the whole province, than could be arrived at by attempting birth registration in each of the 648 circles of the province.

Independently of local inaccuracy of record and diagnosis the method of arriving at the facts is by no means perfect, but it may be stated with truth that efforts are being persistently made to improve the whole registration.

37. In our memoranda on the reports of local Sanitary Commissioners we have discussed this subject of registration as it relates to different Governments, and we shall therefore give the general results briefly as part of the year's sanitary history.

The following abstract gives the birth and death ratios for each province in 1883:—

Province.	Ratios per 1,000.	
	Births.	Deaths.
Bengal	22·03*	18·82
North-West Provinces and Oudh	40·84	27·57
Punjab	39·00	25·25
Central Provinces	40·59	34·56
Berar	40·30	51·30
British Burma	22·92	14·67
Assam	23·91	27·14
Madras	27·70	19·00
Bombay	30·50	25·53
Mysore	24·10	15·11
Coorg	13·48	21·75

* Mean of 46 municipalities.

These ratios represent only the present results attained. The least satisfactory are those for Bengal. In some the registration itself is in defect, in others the population element used in calculating the ratios is under-estimated or over-estimated. The best results appear to be those reported from the North-West Provinces and the Punjab, but taken as a whole they can scarcely be admitted as setting forth the relative sanitary state of the provinces.

38. We shall next give a brief account of the death causes in 1883, arranged under the customary heads. The actual registered deaths were as follows, for the total registering population of 197,614,787:—

Diseases.	Total registered Deaths.	Ratio per 1,000 of Population.
Cholera	244,376	1·23
Small-pox	232,363	1·12
Fevers	2,879,659	14·63
Bowel complaints	261,623	1·33
Injuries	76,059	0·39
All other causes	889,243	4·50
All causes	4,583,323	23·20

It will be observed that, with the exception of small-pox, cholera was the least fatal of the year's epidemics. In our memoranda on the provincial reports we have given the histories of local outbreaks, and we must refer to these for details, but it may be of interest to inquire what has been the history of Indian cholera for a series of years, so far as this can be done from available statistical data. Unfortunately the data are not recorded uniformly, and the registration has been improving to such an extent that if the actual annual deaths had remained the same year after year the improved registration would show very considerable increase of cholera mortality.

39. The following figures for the last 10 years, 1874-83, must therefore be accepted as showing approximately how many cholera deaths were registered. This is reliable, but whether the registered deaths afford an index to the relative annual mortality is matter of estimate:—

Years.	Total Registered Cholera Deaths.							
	Bengal.	Assam.	North-West Provinces and Oudh.	Punjab.	Central Provinces.	Berar.	Madras.	Bombay.
1874 -	56,876	16,478	6,464	78	14	2	333	32
1875 -	109,998	6,616	64,427	6,246	14,648	22,465	94,547	47,573
1876 -	196,590	8,615	48,311	5,736	20,124	2,683	148,189	32,117
1877 -	155,805	11,377	31,770	29	3,418	842	357,430	57,228
1878 -	96,192	6,732	22,221	215	40,985	34,306	47,167	46,743
1879 -	136,363	17,415	35,892	26,135	27,575	223	13,296	6,937
1880 -	39,648	2,803	71,546	274	380	1	613	684
1881 -	79,180	5,010	25,865	5,207	9,449	3,404	9,446	16,694
1882 -	182,352	21,055	89,371	39	11,922	3,573	23,604	7,904
1883 -	90,439	14,908	18,160	190	16,235	27,897	36,284	37,954

On casting the eye down these columns it is impossible not to recognize how extremely variable and subject to sudden outbursts is this great epidemic disease all over India. It is apparently subject to no law of succession. One year's experience affords no guide either to the epidemic history of past years or to the probable history of years to come. At first sight certain of the columns appear to show diminishing mortality, but the very next year effaces any such impression, and leaves us with an insoluble problem. The Madras experience is no exception to this rule, although there has been a great reduction in the mortality since 1877, because this year and the year which preceded it were the years of famine, which were marked by one of the greatest epidemics on record. So far as we know such intercalated events might appear at any time, and it is to be regretted that there has been no advance in effective sanitary work among the towns and villages of the civil population, except perhaps in the case of the Punjab, to exert any marked protective power over the population.

40. Were it not that we have other experience in India than that furnished by the civil population, our hope of reducing cholera mortality by removing its local causes would be very small. But such experience as we have throws a totally different light on the figures of the preceding table, and converts them into indices of great local sanitary negligence. For example, local fairs and pilgrimages, which used formerly to be the real foci of local epidemics, have ceased to be so wherever cleanliness has been enforced, pure water provided, and overcrowding prevented. This rule holds universally, subject, however, to a very instructive exception, and this is, that the absolute immunity of the people at these fairs depends, to a certain extent, on the epidemic intensity in the district where the fair happens to be held. If the district mortality be not excessive the fair people will escape, but, if the district mortality be high, some of the fair people will suffer, but never to the ratio of the local population. That is on the supposition that the usual precautions are adopted.

Next let us take the jail experience, which is thus stated by Dr. Cuningham in his book on cholera:—"The great fact stands out that the annual average death-rate from cholera among "prisoners during the period 1859 to 1867 was 10·77 per 1,000; in the next period, 1868 to 1876, "it was 3·28 per 1,000, and in the third period, 1877 to 1883, it was 3·61 per 1,000," but this latter period includes the famine. Of course the reduction in jail cholera mortality to about a third is in one sense satisfactory, and has corresponded with the advance in sanitary improvement in prisons, and, so far, the illustration is a good one; but why, we feel inclined to ask, is there still a third of the old rate remaining? and why should this third be twice the loss from cholera among Native troops? If we take 1883 for both groups, we find the Native troops yielding a cholera death-rate of 1·15 per 1,000, and prisoners a rate of 2·28 per 1,000.

41. Experience yielded by European troops is equally instructive as to the protective value of sanitary measures during times of cholera. We have already shown what this has been, but we may reproduce the table from Dr. Cuningham's book on cholera, where it stands as follows:—

Presidency.	Annual average Death-rate from Cholera.		
	1860 to 1869.	1870 to 1879.	1880 to 1883.
Bengal - - -	9·24	4·18	2·49
Madras - - -	2·56	1·68	0·90
Bombay - - -	4·80	1·53	0·45

It ought, at the same time, to be stated that the cholera death-rate for the whole European Indian Army in 1883 was ·92 per 1,000, and for Native troops 1·15 per 1,000, as we have stated above. Let these ratios be compared with the figures for the civil populations in the previous table, which yielded for all India, including the population of large exempted areas, a rate of 1·23 per 1,000, and surely no further argument will be needed to enforce the necessity for pressing forward the sanitary improvement of towns and villages. But even in this aspect of the case we have experience to guide us. Take, for instance, the case of Bombay city, where the statistics of 17 years before the initiation of sanitary works yielded an aggregate of 37,454 deaths from cholera, and the subsequent 17 years of slowly advancing sanitary work, and increasing population, an aggregate of 12,026 cholera deaths. If similar work had been done for the Presidency the cholera death-rate ought to be a third of what it is.

But perhaps the most striking experience is that of Calcutta, because it shows the effect of cholera epidemics on two groups of population adjoining each other—the *municipal city*, within which drainage and water-supply have been in use for a number of years, and the *suburbs*, which lie outside the municipal works. The following has been the cholera mortality in these two groups for a period of five years:—

Years.	Cholera Deaths per 1,000 of Population.	
	Calcutta.	Suburbs.
1878	3·0	9·3
1879	2·7	7·4
1880	1·8	3·8
1881	3·9	7·2
1882	5·1	9·3

These figures teach their own lesson in a very practical way, although we are by no means prepared to adopt the Calcutta ratios as showing what can be done in mitigating or preventing the local causes of cholera.

42. Some account of these local causes, as they exist in different provinces, are given in the present and preceding memoranda. Our object is not to reproduce the facts, but to show that, if the knowledge and experience we already possess is turned to proper account by local authorities all over India, the cholera statistics will very speedily testify to the results to public health.

43. In previous memoranda we have given a summary of experience in cholera hospitals on the liability of attendants on cholera cases to attacks of the disease, and the following results are abstracted from tables in the present Report giving the facts for 1883. Cases of cholera, 697 in number, were received for treatment into 91 hospitals of British and Native troops and jails. Into 75 of these hospitals 303 cases of cholera were received, and were attended by 852 attendants, none of whom were attacked by cholera. Into 16 hospitals there were received 394 cases of cholera, attended on by 557 attendants, of whom 31 were attacked. No account is given of the nature of cases returned as cholera among attendants, or of the number of deaths, except the apparently incidental information in a foot note that in one hospital three sweepers had had "choleraic diarrhœa." Of 31 attacked attendants 12 were on service at one station, Kamptee, in the Central Provinces, which happened to be situated in a district where cholera prevailed with great intensity, besides being itself peculiarly liable to epidemic diseases. In 1883 there were 13 cases of cholera among British troops at Kamptee, and 185 cases among Native troops and followers, apparently, at this station. Of course, even during a great epidemic, such an occurrence is sufficient to show that there is something radically wrong at this place, and we would strongly advise that the whole subject should be inquired into, and protective steps taken for the future. The experience moreover, appears to show that local epidemic intensity renders hospital attendants more liable to attacks, as it also does other people.

44. The state of the locality itself has of course an important relation to liability to cholera during epidemic seasons, a fact which was well illustrated during this Kamptee outbreak. Two of the Native regiments which suffered had in all 192 cases of cholera, only five of which, however, took place after removal to camp.

Similar experience was obtained with British troops at Allahabad. When cholera appeared among them the men were divided into twelve parties and sent into camp. In ten of the parties the disease was checked by one removal, and in the other two by a second removal.

An incident, bearing directly on the reasons of this local liability to cholera, is mentioned by the Medical Officer of Jalpaiguri jail as follows:—"During levelling of the ground inside the jail, "peculiar stinking emanations used to appear from the dug up loose earth. It was a strange "coincidence that whenever the levelling operation was being carried on, fresh occurrence of cholera "used to take place." In this instance there could have been no subsoil drainage, as it is stated that there were dirty pools about.

In Buxar jail night-soil was buried within the jail precincts, and cholera cases were most numerous near the pits.

Similar general conditions, leading to impure emanations in close weather, as well as to foul well water, are the common localizing causes of cholera among the civil population, and there is besides

all the beneficial experience of removal from the locality whenever the people desert affected villages.

45. So far as concerns cholera, our experience everywhere may be said to be complete on the following points, which agree with the deductions from Indian experience by itself as hereafter to be stated:—

(1.) That there can be no manifestation of cholera without the antecedent presence of the epidemic whatever that may be,

(2.) That cholera has a distinct tendency to attach itself and its ravages for a limited time to special localities.

(3.) That the best thing to do at present when cholera appears in a locality is to leave it, and not to go into it until after cholera has disappeared.

(4.) That there is plenty of experience besides that contained in the present Report to prove that this property of localization is always more or less connected with putrescence of organic matter in the subsoil or on the surface.

These simple sanitary facts cover the whole ground practically for India. They can be all dealt with, as indeed they have been, at stations and jails.

The surface can be kept clean, and the subsoil can be drained and so cleansed as to put a stop to well pollution, and if this be efficiently done and constantly attended to there will be little to fear from cholera.

We have not alluded to recent cholera theories, to be afterwards noticed, nor to supposed spread of cholera by infection, for neither enter into the practical sanitary history.

46. We shall conclude these general remarks on cholera in its aspects as an Indian epidemic with the following monthly registered cholera deaths for the whole of India, referring to our memoranda on the provincial reports for the local details:—

Months 1883.	Total Cholera Deaths.	Months 1883.	Total Cholera Deaths.
January	16,588	July	44,877
February	7,265	August	41,395
March	2,427	September	9,584
April	18,697	October	6,165
May	25,549	November	10,891
June	31,991	December	22,952

This abstract shows that the cholera year consists of two epidemic periods, April to August and November to January inclusive. The large increase in January takes place in Bengal.

47. *Small-pox and Vaccination.*—We have already given the small-pox mortality as registered at 232,363 deaths, and it is sufficient evidence of the growing importance of this epidemic disease to state that the mortality from it in 1883 fell short of the mortality from cholera by only 12,013 deaths.

The monthly small-pox mortality for the whole of India was as follows:—

Months, 1883.	Small-pox deaths.	Months, 1883.	Small-pox deaths.
January	16,908	July	20,193
February	21,476	August	10,266
March	30,550	September	5,494
April	33,023	October	4,284
May	36,595	November	5,918
June	29,679	December	12,982

This abstract appears to show that rising temperature is a pre-disposing cause of small-pox.

To cope with this epidemic, the following special vaccination service was employed during 1883:—

Sanitary Commissioners	9
Deputy Sanitary Commissioners	14
Superintendents	44
Deputy Superintendents	20
Native "	260
Average vaccination staff	3,693
Total special staff	4,040

The vaccination and re-vaccination work performed by the special staff was as follows:—

Total vaccinations, primary and re-vaccinations	4,690,257
Successful vaccinations, primary	4,338,508
Re-vaccinations	66,663
Total successful	4,405,171

But besides the work done by the special vaccination staff, there is a considerable amount of vaccination work done by dispensaries all over India. Besides the dispensary officers there were 224 vaccinators attached to dispensaries in Bengal and 28 in the Punjab. The successful vaccinations performed by these institutions in 1883 were 213,991, and of re-vaccinations successful there were 4,866. Classing together the successful vaccination work of both agencies the primary vaccinations numbered 4,552,499, and the re-vaccinations 71,529.

But in estimating the probable protective efficacy of vaccination, the ages at which the operation has been performed are perhaps of more importance than the actual number of operations. The younger the age the more complete is the protection. The tables show that out of the total successful vaccinations performed those under one year of age amounted to 1,734,334, a number which ought to be compared with the births in order to complete our estimate of the real value of work done. Unfortunately we do not know the numbers born in India as a whole. There are various estimates in different provinces, but if we assume a general birth-rate of 34 per 1,000 as sufficiently near the truth for our purpose, we shall find that the population yielding the small-pox deaths ought to yield 6,718,000 births, a number which ought to be compared with the 1,734,334 successful vaccinations under one year of age. The facts show that every effort should be made to extend vaccination at ages under one year. But small-pox is an epidemic, and conforms to the law of unhealthy locality as does cholera, and its predisposing causes must be dealt with locally. The vaccinator's lancet has no power over them.

48. *Fevers.*—The removable causes of Indian fevers are so purely local and personal that we have said all that is necessary about them in the provincial memoranda. It may be a further incitement, perhaps, to more strenuous application of remedial measures, if we state the monthly mortality for the whole of India, as follows:—

Registered Deaths from "Fevers" in 1883.

Months.	Deaths from Fever.	Months.	Deaths from Fever.
January	263,526	July	218,212
February	214,914	August	237,634
March	218,337	September	236,288
April	223,390	October	247,146
May	220,849	November	287,634
June	211,720	December	330,939

There are confessedly grave errors in the fever registration for reasons we have often stated. We know not the precise mortality from fever, but if, for the sake of its teaching, we adopt the year's results of this table, these will represent about 57½ millions of fever attacks, and every such attack represents loss to India and poverty among the people. A correct diagnosis of fever would, no doubt, lessen the blame thrown on this one disease, but, as a general fact, it may be admitted that all the "fever" deaths have been preceded by febrile symptoms, and represent loss wherever the blame be eventually thrown.

49. *Bowel complaints.*—Deaths so classed are generally caused by diarrhœa and dysentery, and as we have given the total monthly deaths from other epidemic diseases, the following abstract may be added for the sake of comparison:—

Month.	Bowel Complaint Deaths.	Months.	Bowel Complaint Deaths.
January	19,986	July	25,737
February	15,978	August	30,863
March	16,328	September	26,709
April	18,009	October	22,972
May	20,057	November	22,357
June	20,286	December	22,325

As a whole, the hot rainy and drying up months yield the highest death-rates from diarrhœa and dysentery, but the deaths in this abstract may be safely estimated as being far below the true mortality.

50. *Injuries.*—Among the 76,059 deaths so registered there were included 8,133 suicides and 23,988 deaths from snake-bite and wild animals, the last representing a loss of useful lives which admits of reduction, especially in the loss from snake-bite. The mortality from injuries in 1883 exceeded that of the preceding year by above 2,000.

51. *All other causes.*—Under this head are included 889,243 deaths, and of these no account can be given. The only remark which appears to be called for on this point is that perhaps further inquiry might do for the whole of India what has been done in the Punjab in rescuing the approximate mortality from pulmonary diseases out of the general confusion. It appears to be time to try at least to improve the diagnosis as well as the registration. Having now concluded our abstract of the year's disease history, we shall state briefly what steps of a preventive character have been taken in Bengal.

52. *Sanitary works, military.*—The following amounts were expended in Bengal Presidency under this head:—

	R.	A.	P.
Original works	2,690,982	14	7
Repairs	2,076,471	15	2
Establishment	1,360,112	5	2
Tools and plant	49,963	11	9
Barrack department	357,794	4	10
Total	6,735,325	4	10

In round numbers the works executed for improving military stations in 1883 may be taken at 670,000*l.*

The works of the year include new barracks at Lucknow, Darjeeling, Peshawur, Quetta, Buxa, Peshin. Cherat is to have new barracks and also other advanced posts. Officers' quarters have been in progress at Quetta and Peshin.

A large Native hospital had been built for the garrison at Rawulpindi, and others were in progress. Several military prisons had been finished, and three gymnasia had been erected.

Improved barrack roofing and flooring, also ceilings, had been provided at many barracks and hospitals. Many commissariat buildings, including bakeries and slaughter-houses, had been erected.

The great military road from the mouth of the Bolan Pass to Quetta was under construction. Under general cantonment works were included the completion of Peshawur water-supply; the extention of Umballa water-supply, water provision for Peshin, and the supply for Chakrata had been begun.

Drainage works for Naina Tal had been carried out, and the drainage of Quetta was in progresss, and also its cantonment roads.

53. There is no information in this section of the Report on the all-important subject of improvement in station details, upon which the health of troops mainly depends; but a certain amount of information on the present condition of 67 cantonments in Bengal Presidency can be obtained from a tabular summary of cantonment reports, which we shall very briefly notice.

We have already seen that the death-rate average for all Bengal stations had fallen in 1883 to 11·21 per 1,000, of which only ·94 per 1,000 was due to cholera. The average of 10 years, 1870–79, had been 21 per 1,000, and in 1880 it had been 27·73 per 1,000. The rate had fallen since then to the 1883 rate, which in its turn was, of course, made up of the average of higher and lower rates.

Some single rates in 1883 were excessive, such, for example, as the rate of *Chunar*, which reached 97·22 per 1,000, but there were only 72 men there. Of course the number is too small to be used for comparison, but when we look at the death causes this view undergoes modification, for we learn from them that seven men died during the year, that four of these deaths were due to cholera, two to enteric fever, and one to diarrhœa, while the 72 men had an admission-rate among them of 1,680·6 per 1,000. Now here, surely, was a case in which an exhaustive sanitary inspection ought to have revealed some cause or other for these results, yet the only one assigned is proximity to the river bank during drying up, to which intermittent fevers are attributed, but these were not the death causes.

Benares yielded a death-rate of 39·89 per 1,000 out of 376 men. One death was due to cholera and two to remittent fever. The death-rate was not due to epidemics, but to more general causes of ill-health.

Dinapore, out of a strength of 932 men, had 25 deaths, or 26·82 per 1,000, but of these deaths seven were due to cholera, seven to enteric fever, and one to remittent fever. In this case it is stated that there are watercourses and reservoirs in connexion with irrigation, which is carried on to a considerable extent around the station, but it is evident that there must have been something else at fault.

In 11 months *Moradabad* lost five men out of 191, and two of the five deaths were due to enteric fever. The death-rate was 26·18 per 1,000. There are tanks within cantonments at this station, and the barracks are defective in ventilation.

Delhi, with 401 men, had a death-rate of 24·94 per 1,000. Out of 10 deaths in this station two were due to enteric fever and one to intermittent. The local position of the fort and cantonments on the banks of a large rising and falling river is assigned as a local disease cause.

Shahjehanpur had a death-rate of 23·61 per 1,000 out of 210 men.

We have noticed these stational death-rates as being most largely above the average of the Presidency, merely to show the necessity of making minute practical inquiry into causes and remedies. Speaking generally, the cantonment notes show want of drainage and other causes of water-logging. In some cases defective conservancy arrangements and need of greater care in disposal of sewage. Some water sources were found impure. But there are also evidences of progress in sanitary work.

Muttra, out of 341 men, lost only one by death, and the cause is not assigned. The record of sanitary work at Muttra stands as follows:—Several drains for bath and ablution water were formed of masonry. Barrack bungalows were re-roofed and their ventilation improved.

The lesson which appears to be taught by the present state of these cantonments, so far as can be gathered from the report abstracts, is that since the general death-rate of the Bengal European Army has fallen, and as further reductions appear to be dependent on carrying out sanitary work, especially subsoil drainage, that the stations yielding the highest rates from cholera, fevers, and bowel diseases

should be taken in hand and dealt with as the chief offenders. Effort in this direction is in strict accordance with the true principles of sanitary economy, which teach us that where means are limited they should be expended where they are most required.

54. *Sanitary works, civil.*—In our memoranda on the separate provinces we have given the chief results of the year under this head, but we may here state that sanitary work is further advanced in the Punjab than in any other Government. Everywhere, however, the work has been chiefly confined to towns and municipal districts, and we fear that the view of the Sanitary Commissioner, where he says that "very little appears to have been done during the year to improve the sanitary "condition of villages in Bengal," is one generally applicable.

55. *General remarks.*—This head, which forms the 10th section of the Report, is devoted to a discussion on the supposed "cholera bacillus" and its relation to cholera. The subject is so thoroughly used up that it would scarcely require notice, were it not that it involves errors which may at any time be reproduced to the detriment and misdirection of sanitary work. Even in the present case a public attack was made at the International Health Exhibition on the Indian sanitary service, on the ground that its discouragement of theoretical discussions had probably prevented the Indian medical service from discovering this same cause of cholera, and it need scarcely be said that all the theorists received Dr. Koch's bacillus thankfully as a vindication of their standpoint.

As this matter forms part of the present Report, and also of a separate publication of Dr. Cunningham on "Cholera, what can the State do to prevent it?" which is in reality an appendix to the Report, we shall briefly notice the discussion as part of the year's sanitary record. Ever since cholera appeared in the West attempts have been made by the use of microscope and by other methods of inquiry to obtain some knowledge of the pathology and etiology of the disease, and these attempts have ranged themselves under two classes, those cases,—namely, in which only a record of the observations was kept for future use, and those in which observations, sometimes of a trivial character, were made the basis of a theory about cholera, its treatment and prevention. Observations of the first class have always been of use, even negatively, while those on which theories have been founded have been soon set aside for others apparently more plausible, but they have also done mischief by placing the theoretical element in the foreground of the question, to the detriment not only of advance in real knowledge but to the adoption of suitable measures of prevention. We may select a case or two of each class to illustrate this matter. During the cholera invasion of 1848–49 certain minute organisms were discovered by the microscope in choleraic matter which were supposed to be new, and they were considered by many persons to be the germs of the disease. This was, however, merely a mistake in interpretation, because the objects had another origin altogether. During the cholera of 1854–55 the General Board of Health appointed a Committee to take up the microscopic part of the work, and they discovered and figured similar microscopic objects in cholera excreta, bad water, and impure air.

They however applied the necessary test of inquiring whether these microphytes were peculiar to cholera, and they found they were not so. They were vibriones of not uncommon occurrence, and hence it could not be inferred that they had any causative relation to cholera, but even this negative result was of importance.

At a later date an observation, and a theory founded on it, attracted much attention, namely, the rice fungus theory of Professor Haffer, of Jena. This theory had a certain importance, because it led to the first detailed microscopic inquiry in India, which was ably carried out by Drs. Lewis and D. Cunningham, with the result that the rice fungus theory was completely disproved, and a large amount of interesting information on the minute pathology of cholera, and on the relation of soils, subsoils, air, and water impurities to the epidemic was obtained. In this case no theory was enunciated, only facts were recorded, and these remain with all their value for future use.

The latest investigation at Calcutta by Dr. Koch and his colleagues resulted in obtaining facts, and in founding on them a theory about the cause of cholera, which has since been called in question, apparently because the same tests were not adequately applied during the inquiry as were made use of by the London Committee in 1855. Beyond doubt the German Commission discovered in cholera cases, and in certain water tanks, a very minute curved microphyte to which they gave the name *bacillus*, although equally high authority in this country has pronounced the organism to be a spirillum. This, however, is of small moment in the discussion, because it has been since affirmed by Drs. Klein and Gibbes, who were sent by the India Office to continue the investigation independently at Calcutta, that the microphyte is not peculiar to cholera cases (just as in 1855 the same thing was proved in regard to vibriones), that the use of water containing it was not necessarily followed by attacks of cholera, that cholera cases showed themselves where the water was quite pure and free from these bodies, and, moreover, Dr. Lewis has since shown that the same, or a similar *bacillus*, is an abundant inhabitant of the mouths of healthy persons, especially of children, far away from any cholera district. Dr. Koch has since denied the validity of these observations, and we must wait the results of further investigation and discussion before arriving at any conclusion on the matter. We have only to add, that in none of the inquiries has it been found possible to communicate undoubted cholera to any animal by cholera material, and there is not a single instance on record of cholera having been accidently communicated in this way to man, notwithstanding the continual practice of postmortem examinations.*

56. We have thought it necessary to make this statement, not for the purpose of throwing discredit on legitimate attempts to extend our knowledge on a subject of great importance, but simply to point out that, up to the present time, these inquiries have afforded us no help in understanding what cholera is and how human life can be saved. We may, therefore, set them aside, and take up the question on the ground of experience gained in this country, and where Dr. Cunningham has taken it up for India in the present Report.

* And recently of sub-cutaneous inoculations in Spain on a very large scale.

57. Amidst all the diversities of opinion which have existed about cholera, there is one circumstance, the importance of which cannot be over-rated, and this is that, ever since cholera appeared in the West, its incidence among any population has been acknowledged simply as matter of every day experience to be related to the conditions of life in the affected places. So much has this been the case that it has long been known that leaving affected dwellings ensured the comparative immunity of their inhabitants, while the removal of unhealthy local conditions kept the epidemic in abeyance. The proof of these laws, long known in the West as regards cholera, has been obtained during the 20 years of Dr. Cuningham's service as Sanitary Commissioner for India, and in the present Report and its Appendix he has sought to enforce their supreme importance as including the only real principles of action on which any dependence for safety can be placed.

There is nothing new in the proof. He has merely brought under one view the continuous every day experience passing under his eyes, and such as it has been set forth year after year in sanitary reports from all parts of India. So that there is now a continuous invariable testimony on the subject from every country where cholera has appeared, but, as men's minds are not all alike, there have been at the same time not facts, for there are no facts, but beliefs, on the subject which have led to dependence on restriction of human intercourse as the sole means of preservation against epidemics. This matter enters also into Dr. Cuningham's discussion, but, as the whole of it has been discussed to an extent almost beyond its importance, we shall merely state the general result of this immense Indian experience:—

1st. That to which we apply the name of "cholera" is only an effect of a cause of which we know nothing. All we can do practically is to study the effect and its relations.

2nd. As the presumed cause must precede the effect, it may exist without making its presence known. It is this cause to which the empirical name of "epidemic" is applied.

3rd. We can conceive this epidemic cause as being so intense as to destroy all life, or as being so feeble as not to show its presence. Practically, however, it is consistent with every day experience to state that it always manifests itself where certain local and personal conditions exist, and hence that the epidemic law can only be studied through local epidemic incidence.

4th. On this fact is founded the whole science of epidemic statistics, and, if we desire to obtain any practical information on the subject of cholera, the first thing to do is to master the statistical evidence. This point is fully discussed by Dr. Cuningham. He has confirmed the previous view of Dr. Bryden, that there is an endemic area within which cholera is always present in varying intensity in different districts of it, and at different seasons; that cholera appears far outside this area, and in Bengal always moves up, and never down, the great rivers; that the movement has no relation to river traffic, or to railways, roads, or any movements of population, and he supports this view by the following curious facts, which, on certain favourite methods of reasoning, would show that railways were protective against cholera.

Average annual cholera death-rates per 10,000 of population for a period of 12 years:—

Districts away from the Line of Railway, and comparatively difficult of Access.		Districts on Line of Railway.	
Azamgarh	11·17	Allahabad	7·37
Gorakhpur	12·65	Futtehpur	5·06
Basti	22·60	Cawnpore	5·13
Gonda	19·38	Etawah	3 67
Bahraich	14·97	Unao	7·04
Kheri	14·45	Lucknow	8·88

This 12 years' contrasted experience shows that cholera depends for its movement on some other agent than human intercourse, and also that the intensity of the epidemic as evidenced by the death-rates varies greatly in different regions of the country, for we can scarcely suppose that the sanitary conditions varied so greatly as to account for the great difference in death-rates.

He shows further that, as has been known all along, a cholera epidemic moves in a certain definite direction, and that persons advancing in the same direction may apparently yield the first cases of cholera where they stop, whereas if they turn aside out of the stream they may die, and no one else may suffer near them. Cholera-infected regiments have moved against the epidemic current without spreading cholera. If they marched with it they might appear to carry the disease.

58. In a country like India, where all localities are bad, it is difficult to find exceptional cases, but it is certain that cholera swoops down on bad insanitary localities, and, as we have already shown, the prevalence of cholera in stations of British and Native troops, in jails and in large cities, has been greatly reduced by sanitary works and measures. Bad localities have been converted into good ones, and have comparatively escaped, yielding perhaps the best form of proof.

On the contagion side, on the other hand, these 20 years' experience have failed to yield any evidence of the spread of an epidemic by human intercourse, or of the arrest of an epidemic by any quarantine procedure. Practically, therefore, the whole epidemic history resolves itself into a local question. Keep localities occupied by population groups in a wholesome condition, and there will be little to fear from cholera. If this has not been done the safest way is to leave the locality for the time. And care should always be taken not to enter a place where cholera is known to be present.

59. The conclusion of the whole matter is that so-called sanitary administrations should cease to waste their strength on impossible and useless restrictions on intercourse, and Dr. Cuningham

concludes, as the first general Board of Health in this country concluded after the experience of 1848–49, with these words:—"Once accept the great principle that the improvement of local "conditions is the one and only principle on which the State can act with advantage in matters of "public health, and the solution of the whole question will be comparatively easy. Sanitary "administration will then no longer attempt to accomplish impossibilities, but will be directed to "those great practical reforms which cannot fail to improve the health, and thereby add to the "happiness and prosperity of the people."

60. This conclusion, which Dr. Cuningham has set forth as the end of 20 years of most useful and important public health work in India, although specially referring to cholera, includes the future principles of Indian sanitary improvement. After the experience already obtained in dealing with sanitary problems at British and Native stations, in jails, and among certain groups of the civil population, it is no longer possible to ignore or to under-estimate the importance of the facts in their bearing on Indian sanitary progress and work; and in order that those supplied by Army experience may not be overlooked or forgotten, we shall conclude our notice of this, which is Dr. Cuningham's last Report for India, by a brief historical statement of the facts.

61. The Report of the Royal Commission on the Sanitary State of the Indian Army, which was issued in 1863, contained two estimates of Army mortality. A death-rate of 69 per 1,000 was described in the Report as the figure round which the death-rates of the Company's troops during the years from 1800 to 1856 has oscillated. The other statement, referring to the mortality of troops of the line, was laid before the Commission by the late Sir Alexander Tulloch. It was extracted from the War Office returns for the years from 1817 to 1855, and gave the annual average death-rate for the whole period as 70 per 1,000. These were the rates for the reduction of which sanitary works and measures had to be devised and executed. For this object the Royal Commission immediately on its appointment in 1859, sent instructions involving sanitary procedure for inquiries to be made at every station in India, and two results followed. A very complete account of sanitary condition was obtained, and improvements were begun. The Royal Commission further advised that the experience obtained by the Commission for improving barracks, hospitals, and stations at home should be used in dealing with the corresponding Indian problems. The Commission was reconstituted for the purpose, and became the Army Sanitary Commission, and the India Office requested it to prepare a Code of "Suggestions" for Indian stational improvements. This was issued in 1864, and circulated all over India for the information of local officers in drainage, water-supply, barrack and hospital construction, &c. One section of it gave details for the registration of deaths in India. And our Commission has continued since then to give advice and assistance on all sanitary questions and details referred to it. The Code was revised at the request of the Government of India and the India Office, and re-issued in 1882.

62. In estimating the possible saving of Army life, the Royal Commission considered that the death-rate of 20 per 1,000 ruling among Indian civil servants ought to be attainable for soldiers by the application of ordinary sanitary methods. But they went beyond data of this class, and drew pointed attention to sanitary work which must in time be done, while they expressed a hope that when the stations and their vicinity were brought under proper sanitary regulation "the natural "death-rate in times of peace of men of the soldiers' ages in India will be no more than 10 per 1,000 "per annum."

63. We have already shown how the death-rates have been falling under sanitary work in years of peace, and how they are temporarily raised in war years. But we have now arrived at this point, that up to the time of the Royal Commission of 1859 the station death-rates in India had been on an average 69 and 70 per 1,000, while in 1883 the rate was 10·88 per 1,000 for the whole Indian Army.

The death-rate of a single year cannot, however, be accepted as an indication of permanent improvement. An epidemic of cholera might very soon raise it for the time. But any neglect of sanitary measures or any surrender of the ground already gained would necessitate both labour and expenditure to regain it. What has now to be done is, not only to keep what has been got, but to improve on the acquisition, and we have called pointed attention already to the direction in which future sanitary work should be carried out at the stations.

64. The Appendix to Dr. Cuningham's Report contains the usual indispensable statistics prepared by Dr. Stephens, besides two interesting reports on an expeditionary force in Assam in 1883–84, and on the Indian division of the Egypt expeditionary force in 1882. Both these reports are departmental, and do not call for remark.

65. In conclusion, it is matter for congratulation to all interested in public health improvements to find from this 20 years' experience that sanitary measures lose none of their efficacy in warm climates. They have done more for the Army in India than for the Home Army merely because there was more to be done, and what has been accomplished for the Army can, beyond a doubt, be done in its degree for the civil population. When the work at home was begun, the healthy rural population of England was assumed as affording an attainable health standard for the army. Now in India we can hold up the Army, British and Native, as affording a health standard to be aimed at for the country population. The work for this vast population has to be done, and can be done, and in our "Suggestions" we have pointed out the way.

21st July 1885.

No. 2.

Memorandum of the Army Sanitary Commission on the Report of the Sanitary Commissioner for Madras for 1883.

This report contains less sanitary information than usual, and the public health part of it is mainly confined to figures, the relation of which to disease causes and their remedies has been passed over apparently from delay in the receipt of information, and with regard to one very important subject, the severe cholera epidemic of 1883, no details are given. They had been received, but were so voluminous that time was required for their consideration. We are, however, promised some account of this epidemic in a separate form.

It is necessary to refer to these matters, to account for the absence of detailed information in the present Memorandum on the chief diseases of the year.

2. The population of Madras Presidency, according to the census of 1881, and exclusive of Europeans and Eurasians, was 30,835,771,; but the population making returns of births and deaths is given at 28,503,100.

3. The registered births among this population were made up of—

Males	404,937
Females	386,837
Total	791,774=27·7 per 1,000.

The relation of this birth-rate to those before and since the famine of 1877–78 shows some points of interest as follows :—

Years.	Birth-rates per 1,000.	Years.	Birth-rates per 1,000.
1876	21·6	1880	22·9
1877	16·3	1881	25·5
1878	11·9	1882	26·0
1879	16·4	1883	27·7

Up to 1876 the birth-rate registration had been improving. The famine set in severely in 1877, and there was an immediate drop in the numbers registered, partly because the registration fell off during the famine; but of recent years the numbers born and the births registered appear to have increased, although the birth-rate registered in 1883 can scarcely be accepted as the true rate. For the last four years, however, the birth-rate has been steadily rising. In several districts the registered birth-rate exceeds 3 per cent., and in one district it exceeds 4 per cent. of the population.

4. In 1883 there were registered the deaths of—

Males	278,485
Females	263,445
Total	541,930

equal a death-rate of 19 per 1,000 on the registering population, a rate evidently below the truth, especially as 1883 was an epidemic year. Assuming the same eight years' period for the death-rates as for the birth-rates, and including the famine years 1877–78, we arrive at the following comparative results :—

Years.	Death-ratio per 1,000.	Years.	Death-ratio per 1,000.
1876	23·3	1880	15·2
1877	53·2	1881	16·2
1878	27·8	1882	16·2
1879	18·9	1883	19·0

When the district death-rates are compared with each other, they present little uniformity. The lowest was 13·1 per 1,000. 13 districts out of 32 registered death-rates under 2 per cent., and one district only made returns of 38·1 per 1,000, not too high a figure for an epidemic year.

The result shows that neither birth nor death rates for the whole province are known, although it is probable that the town rates are more reliable. Divided between the town and country populations the death-rates were for—

Towns	24·9 per 1,000
Country	18·6 „ „

5. We shall next show the relative mortality from assigned death causes among both classes of population:—

Diseases.	Ratios per 1,000.			Total Population.
	Total Deaths.	Towns.	Country.	
Cholera	36,284	3·8	1·1	1·2
Small-pox	37,975	1·6	1·3	1·3
Fevers	203,786	5·4	7·2	7·2
Bowel complaints	22,098	2·1	·6	·7
Injuries	11,509	·3	·4	·4
All other causes	230,278	11·7	7·8	8·0
All causes	541,930	24·2	18·6	19·0

For reasons already stated, we have no means of discussing the sanitary history of any of these diseases, and what follows relates to the statistical data which are not altogether reliable.

6. We shall next discuss the statistical data for each disease, beginning with *cholera*.

Cholera prevailed in various degrees of severity in all the districts of the presidency, with three exceptions, Vizagapatam, Kurnool, and South Canara, from which no cholera deaths were returned. In the 19 districts invaded by the epidemic, it prevailed in various degrees of intensity. The north-eastern districts returned very few deaths. In Vellore, Madras, and Chingleput, the epidemic did not appear in force till towards the end of the year. Its course was nearly the same in Cuddapah, Bellary, Anantapur, and North Arcot. But in several districts it appeared as a severe epidemic during every month of the year, and most of the mortality fell on South Arcot, Trichinopoly, Tanjore, Madura, Tinnevelly, Salem, and Coimbatore. Of the 229 circles of registration in all the districts, the cholera mortality was returned from 142 only, and out of 52,051 population groups all the deaths were furnished by 4,413, or under 8½ per cent. of the number; but the proportion of registration circles, as well as of villages attacked, varied according to the intensity of the epidemic, of which, indeed, they supplied an index.

Thus in the seven most severely affected districts, already indicated, cholera prevailed in all the 71 registration circles, with only two exceptions. The same districts contain 16,773 villages, of which 3,859 suffered, or above 20 per cent. of the number.

The epidemic of 1883 repeated the same law of cholera, namely, that it is not generally diffused over a country; that it is greatly more severe in some localities than in others; and that the mortality of any given year depends on the number of population groups attacked, and on the number of deaths in each.

7. Of the deaths from cholera in 1883 the town population of 1,696,075 yielded 6,436 deaths, or 3·8 per 1,000, and the country district population of 26,839,745 returned 29,816 deaths, or 1·1 per 1,000, a ratio which directly raises a question as to whether all the country deaths were returned. Considering the sanitary state of the village populations, the reply must apparently be in the negative.

8. The monthly cholera deaths registered, were as follows:—

Months.	Cholera Deaths.	Months.	Cholera Deaths.
January	3,671	July	2,248
February	1,826	August	1,293
March	1,392	September	628
April	1,007	October	1,347
May	497	November	6,143
June	1,168	December	15,164

This monthly record presents some facts which differ materially from those of ordinary epidemic years. It almost appears as if the first eight months showed the breaking up of one epidemic, to be succeeded afterwards by another of great and unusual intensity, which would pass over to the following year. Such an occurrence would be in conformity with the past history of cholera in Madras, as will be gathered from the following annual deaths registered during the last 18 years:—

Years.	Deaths from Cholera.	Years.	Deaths from Cholera.
1866	200,261	1875	24,546
1867	38,205	1876	249,193
1868	8,036	1877	337,430
1869	21,034	1878	47,167
1870	55,867	1879	13,296
1871	15,956	1880	613
1872	13,247	1881	9,446
1873	840	1882	23,604
1874	813	1883	36,284

On the supposition that the registration of cholera deaths in this table has been fairly correct for the 16 years, we are led to the conclusion that during the last eight years of the series the deaths from cholera have been more than double the number of the first eight years, and even if the enormous death-rate of the famine year 1877 be left out, we should still have to deal with an increased death-rate during the last eight years of the series.

9. It follows, as a matter of course, that no sanitary work which has been done in the towns and villages of Madras Presidency has materially influenced local conditions during the whole 18 years taken at least over the entire population. There are exceptional cases which add stronger proof to the rule that cholera is a test of the health conditions of localities in Madras Presidency, as it is everywhere, for we only know cholera through its manifestations in localities, and we have as complete proof as can be obtained of what the sanitary condition of affected towns and villages really is, and this knowledge leads us directly to the practical remedies required; but beyond this conclusion the statistics tell us that no progress has been made, except perhaps in a few places, in applying the results to practical purposes.

10. *Small-pox.*—High as was the loss of life from cholera in 1883, it was exceeded by the loss from small-pox, which amounted to 37,275 deaths, or 1,691 more than by cholera mortality. Of these deaths, 7,573 were registered as under 1 year of age, 15,736 between 1 year and 12 years of age, and 14,666 at ages above 12 years. Small-pox prevailed as an epidemic over the entire area of the presidency. Every district registered deaths from it, and out of 229 circles of registration 218 were affected. The number of attacked villages cannot be given, but out of 76 towns 60 returned deaths. The country death-rate was 1·3 per 1,000, and the town rate 1·6 per 1,000.

11. The deaths, month by month, were registered as follows :—

Months.	Small pox Deaths.	Months.	Small-pox Deaths.
January	3,519	July	2,623
February	4,489	August	2,378
March	5,429	September	1,706
April	4,161	October	2,041
May	3,309	November	2,000
June	2,594	December	3,670

12. *Vaccination.*—The following was the staff during the year :—

Inspector of vaccination	1
Deputy inspectors, 1st class	32
" " 2nd class	9
Vaccinators, 1st class	254
" 2nd class	373
Probationers	115
Peons	39
Total staff	823

13. The work done by this staff during the year may be summed up as follows :—

Total number vaccinated	735,808
Primary vaccinations	720,349
Of which successful	669,738
Re-vaccinations	15,459
Of which successful	6,976

The protective agency of this work will be better estimated by the following data :—

Average ratio per 1,000 of population vaccinated successfully in five years	16·2
Average five years' deaths from small-pox per 1,000	·8
Births, 1883	791,774
Successful vaccinations under one year of age	127,952
Percentage of successful vaccinations under one year to the year's births	16·
Deaths from small-pox under one year, 1883	7,573

This abstract shows clearly where the vaccination service in Madras Presidency is defective. It is not possible to make any serious impression on small-pox mortality, so far as this can be influenced by vaccination, as long as only 16 per cent. of the children born are vaccinated within a year after birth. The explanation of this state of matters given by the Sanitary Commissioner is that the educated native classes treat the disease with supreme indifference, and that the poor look upon small-pox cases as beneficient marks of their goddess, and are deaf to persuasion in the matter. Of course such a state of feeling can only be overcome by education and advance of knowledge. But it must not on this account be forgotten that small-pox in Madras is an epidemic disease, and like all other epidemics it is influenced in its greater or less intensity by local causes. It is by no means an

occasional visitant, as will be seen by the following abstract, giving the deaths registered from it for the last 13 years:—

Years.	Small-pox Deaths.	Years.	Small-pox Deaths.
1871	20,823	1878	56,360
1872	39,074	1879	17,840
1873	51,782	1880	14,529
1874	48,343	1881	15,776
1875	24,375	1882	20,159
1876	23,469	1883	37,975
1877	88,321		

In the present state of public opinion on the subject of vaccination, it is not likely that these figures, with their recurring years of aggravations (including famine, which always augments the death-rate), will be materially reduced by the vaccination service, although one obvious result of the data as a whole is to point clearly to the necessity of concentrating effort on the vaccination of infants. But when taken in connexion with the cholera mortality they strengthen the conclusion that both epidemics are at present very unnecessarily aggravated by the neglect of sanitary measures. If these were pressed forward more rapidly the vaccinator's work would probably be more effectual.

14. *Fevers.*—The next abstract gives the registered fever deaths for 18 years.

Years.	Deaths from Fever.	Years.	Deaths from Fever.	Years.	Deaths from Fever.
1866	110,102	1872	214,148	1878	374,443
1867	112,311	1873	222,843	1879	285,477
1868	105,692	1874	226,220	1880	209,940
1869	132,846	1875	252,962	1881	203,542
1870	151,027	1876	230,692	1882	188,561
1871	192,469	1877	469,241	1883	203,786

This table bears marks of improved registration as to numbers at least. The nomenclature, however, is not trustworthy, but on the supposition that such errors are more or less constant, these annual data appear to show, like those for cholera and small-pox, that little has yet been accomplished in Madras Presidency to cope with epidemic death-rates. The great rates of 1877 and 1878 afford us no ground for hope in this matter, for the rates of these years included the increased liability to fevers which accompanied the famine. How little we have to expect at present may be learned from the following statement in the Report under review:—"When the poor people learn how to protect "themselves by proper clothing and food from rapid changes of temperature, then the muster roll "of deaths from fever will diminish."

15. It is necessary to say, however, that this is begging the whole question as to the cause of paroxysmal fevers, and the relation of these fevers to the prosperity of the country, and another question has first to be answered, namely, how comes it in such a country as India that there is a deficiency in food and clothing? The reason is not far to seek, and we may ask, with our present knowledge of these fevers and their causes, whether any amount of food or clothing ever prevented a single case? Do Europeans never suffer from these paroxysmal fevers? The real fact is, that we have no proof that defects of this class ever caused a case of ague. The disease must be there first, and being so, its severity may no doubt be augmented by deficiency of clothing and food, changes of temperature, &c. But European every day experience in India shows that no amount of personal advantages of this kind can keep away intermittent or remittent fever. The present Report indeed states that during the last six years there had been 11,735 cases of intermittent fever among European troops who are in want neither of proper food, clothing, nor shelter. What they really need is, that the local fever causes about stations should be dealt with.

16. The object of these remarks is simply to point out the danger of dealing with great and well known general and local causes of fevers and other epidemics as if these depended for their severity merely on personal advantages or wants.

The sanitary rule in such matters has been long known, and it is this, first reduce the prevalence of disease by improving the dwelling and its surroundings; on this there will follow improved stamina and greater ability to work, besides improved habits of life, and, as a matter of course, there will be better food and better clothing, and these in their turn will further improve general health.

To place the last elements first is simply to say in effect that improvement by the people themselves is impossible. The case as it stands is as complete as it need be, and it all tells in favour of action on the part of Government in rooting out those local causes which are known by experience to be the real causes of Indian poverty. How the work can be done most effectually it is for the Government to decide.

17. The monthly prevalence of fever among the civil population was as follows:—

Months.	Fever Deaths.	Months.	Fever Deaths.
January	13,415	July	18,249
February	15,885	August	18,579
March	15,097	September	16,808
April	14,235	October	16,210
May	15,042	November	17,789
June	14,814	December	22,668

Fevers appear to have been most prevalent during the drying up and variable and low temperature months. The fever death-rate for the country districts was 7·2 per 1,000, for the towns 5·1 per 1,000, and for the Presidency 7·1 per 1,000.

18. *Bowel complaints.*—Deaths registered under this head were reported from all the districts, and from 225 out of 229 circles of registration. All the 76 towns, with 9 exceptions, registered such deaths. The district death-rate was 0·6 per 1,000, and that for the towns 2·1 per 1,000. The rate for the whole Presidency was 0·7 per 1,000, against a previous five years' rate of 0·9 per 1,000.

The monthly deaths registered from bowel complaints in 1883 were as follow:—

Months.	Bowel Complaint Deaths.	Months.	Bowel Complaint Deaths.
January	1,901	July	1,946
February	1,481	August	2,273
March	1,346	September	1,991
April	1,296	October	1,884
May	1,448	November	2,352
June	1,551	December	2,879

There is nothing specially calling for remark under this head.

19. *Injuries.*—This section of the tables includes 1,477 suicides, 340 deaths from wounding, 6,874 from accidents, and 2,318 deaths from snake-bite and wild beasts. In all, 11,509 violent deaths.

20. Deaths from *all other causes* numbered 230,278, or 8 per 1,000 out of a total death-rate of 18·9 per 1,000. Of these death causes nothing is known.

21. We shall conclude this notice of the disease history of 1883 with the following comparisons:—

Deaths from cholera, 1883 - - - - - 1·2 per 1,000
" " " previous five years average - - - ·6 "
Deaths from small-pox, 1883 - - - - 1·3 "
" " " previous five years " - - - ·8 "
Deaths from fevers, 1883 - - - - - 7·1 "
" " " previous five years " - - - 8·7 "

Fever mortality is uncertain, for reasons already stated, but cholera and small-pox, which are well known diseases, both show increase, and confirm the view already stated that no impression has yet been made on the epidemic susceptibility of the people.

22. Section VIII. of the Report is devoted to the Army and to the stational reports. We have dealt with the questions in this section on other papers, and we shall only touch briefly on the leading facts for the year.

The strength of European troops on 1st January 1883 was 11,528. In the course of the year there was an increase of 1,930 and a decrease of 2,684, leaving the strength on 1st January 1884 at 10,774.

The following were the sanitary statistics for 1883, in ratios per 1,000 strength:—

Admissions - - - - - - 991·0
Daily sick - - - - - - - 59·7
Deaths - - - - - - - 10·0
Invalided for change - - - - - 20·1
" " discharge - - - - - 13·6

These data show very considerable advance in the sanitary state of Madras stations, but there are still several important stations at which works have to be carried out. These we have dealt with on other papers.

23. *Native Army.*—The medical returns of this army refer only to 24,998 men, and the ratios per 1,000 from inefficiency causes were the following in 1883:—

Admissions - - - - - - - 693·9
Daily sick - - - - - - - - 27·7
Deaths in and out of hospital - - - - 12·4
Invaliding - - - - - - - 26·9

The admission-rate of 991 per 1,000 among European troops includes 243·2 per 1,000 from venereal diseases, which, if deducted, would bring the rate nearer that of the Native Army. The

daily sick and invaliding of the Native Army are both lower, but the death-rate was 2·4 per 1,000 higher than that for European troops.

24. The statistics are followed by a very brief abstract for each of 27 stations occupied by troops. There is nothing in them calling for remark, except the account given of surface sanitary work, which is on the whole satisfactory.

It is apparently in this important matter, and especially in conservancy, that the chief advances in the way of improvement have been made. Of sanitary work proper nothing is reported, except digging a few wells and improvements in surface drainage. We have on other papers called attention to the apparent causes of unhealthiness at several stations, but if the death-rates be averaged over all the stations, there is not much to complain of in this matter. Only the higher rates at the larger stations show in what direction sanitary work is required, and if these matters be attended to, the death-rate of the Madras European Army ought to fall below 10 per 1,000.

25. *Sanitary works, civil.*—The first subject dealt with under this head is the sanitary condition of the Madras jails, which presents some points of considerable interests in their bearing on the sanitary improvement of the civil population generally. The best way to show this relation will be to quote from the Report the following data :—

Years.	Admissions per 1,000 of Strength.	Deaths per 1,000 of Strength.	Years.	Admissions per 1,000 of Strength.	Deaths per 1,000 of Strength.
1861–62	1,502·6	93·0	1873	599·8	28·3
1862–63	1,319·0	89·4	1874	714·1	26·6
1863–64	1,378·6	107·6	1875	752·6	38·7
1864–65	1,491·1	101·5	1876	703·6	42·4
1865	1,290·6	126·5	1877	971·3	175·4
1866	1,249·7	124·5	1878	944·4	125·4
1867	1,012·4	53·9	1879	890·5	55·8
1868	869·1	33·8	1880	854·0	44·7
1869	804·7	41·3	1881	742·5	41·4
1870	735·2	26·5	1882	800·4	41·9
1871	779·9	17·9	1883	865·3	29·4
1872	681·1	22·2			

Up to 1867 the casualties were enormous; but strenuous efforts in the way of improvement were begun about that time, and everything was slowly improving until the famine intervened. This intercalated event gave rise to a very great increase in the jail deaths in 1877–78; this rise was due not to any sanitary retrogression in the jails but to the state of the prisoners on committal, and as the rates continued high during the succeeding years, the figures may be taken as showing that the civil population continued to suffer from the effects of the famine for several years after. The satisfactory point proved by the table is that jail improvements are making progress, and that among a section of the civil population removed and separated from the general mass, it is possible to act both on the sick and death-rates by sanitary work.

26. Another table in the Report gives the deaths from cholera, dysentery, diarrhœa, dropsy, and anæmia for the same years, but instead of quoting this table entire, it will be sufficient for our purpose to give the first and last lines of it :—

Years.	Deaths per 1,000.				
	Cholera.	Dysentery.	Diarrhœa.	Dropsy.	Anæmia.
1861–62	26·3	8·5	14·6	—	—
1866	—	—	—	5·3	12·1
1883	1·9	3·8	5·8	1·5	·5

These contrasted figures appear to show improvement in all the elements of jail management; but the data show also the influence of epidemic intensity on the amount of cholera in jails. There were in all 15 deaths from cholera, nine of which took place among 176 prisoners in Cuddalore Jail, and this jail is situated in South Arcot, which was one of the most severely attacked districts in 1883. It yielded 5,742 deaths from cholera.

27. *Municipalities.*—Excluding the town of Madras, which has a local Act, there are 47 municipal towns, with an aggregate population of 1,729,848, administered under the Towns Improvement Act III, of 1871. Many of these towns have thus been in the hands of the improver for a term of years, and the statistics ought to show us what advance has taken place in the public health.

The following are the data in the Report under review:—

Years.	Total Cholera Deaths.	Total Small-pox Deaths.	Total Fever Deaths.	Death-rates per 1,000 all Causes.
1869	2,048	303	6,359	21·4
1870	3,505	586	6,913	22·0
1871	1,447	1,484	8,403	25·1
1872	716	2,660	9,762	26·6
1873	47	3,913	8,660	27·4
1874	30	2,265	8,874	28·4
1875	7,818	1,161	9,749	32·8
1876	2,430	2,086	8,576	32·8
1877	19,631	11,592	14,049	31·3
1878	3,794	2,908	14,485	33·5
1879	672	2,091	13,182	29·8
1880	36	1,892	11,298	26·6
1881	1,931	2,349	11,274	28·1
1882	3,612	2,392	9,947	28·0
1883	4,878	4,555	10,366	30·0

The earlier years in this list show defective registration, but it cannot be said of the death-rates of the latter years, especially when these are considered with the great losses of life from the common epidemics, that the municipally regulated towns show much advance in real sanitary protective work taken over the whole. Some individual towns show better results than others, but the work done, whatever it may have been, appears to have made little impression on the death-rates, especially from epidemics.

28. The following were the amounts spent for sanitary measures by these towns during the year 1882–83:—

	Rs.
Conservancy	328,870
Improving town sites	30,994
Water-supply improvements	23,693
Fairs and festivals	3,469
Markets, slaughter-houses, &c.	13,678
Other sanitary objects	46,448
Total	447,152

or about sixpence per head of the population.

29. The Sanitary Commissioner describes the year's works as follows:—"They consisted in the "main in the repairing and cleansing of tanks and wells, latrines, drains, dustbins, markets, and "slaughter-houses, in the removal of prickly pear bushes and other rank vegetation, in the con- "struction of latrines, drains, and dustbins, and in sinking of a few wells, and in some other minor "works."

More attention is being paid to drainage and water-supply in some towns than in others. Conservancy is done as usual, and the important step has been taken by several municipalities of carrying out private scavenging including that of the backyards of native houses. This is a step in the right direction, but it should be accompanied by provision for cattle to be removed from these compounds.

29. Details of sanitary work are given for 17 municipalities, which do not require separate discussion except in so far as they afford information on the sanitary condition of the towns, but in this direction they afford some useful details.

The town of *Bellary* has a population of 53,460. Its registered death-rate in 1883 was 22·9 per 1,000, and its quinquennial rate was 30·4 per 1,000. There was very little cholera in the district, and the death-rate from this epidemic was 0·1 per 1,000. The district fever-rate was 5·8 per 1,000. The town epidemic rates were about double those of the surrounding country; for the town population had a cholera death-rate of 0·2 and a fever-rate of 9·9 per 1,000. The question naturally suggests itself whether these double rates have any connexion with the following account of the water-supply? It is obtained "principally from the fort ditch and a large rain-fed tank. Besides "these there are a number of minor tanks and wells, some with good and others with brakish water." Again, as regards drainage, we are told that it "is defective. No improvement since last report. "Numerous cesspools exist." Have we not in these brief statements the elements described of radical unhealthiness?

30. A similar account is given of the drainage of *Adoni*.

31. Of *Conjeveram*, a great pilgrimage place, which of late years has been kept free of cholera or nearly so by active conservancy, it is satisfactory to be told that "a gradual improvement is observable "in the sanitary condition of the town." But the public health cannot be considered as safe where "sewage flows into the backyards of houses and sinks into the soil," and where some of the tanks belonging to temples "are subject to all kinds of pollution, nor are the wells free from it."

32. Of *Coimbatore*, it is said that "a good drainage system for the whole town is required. Drainage of houses runs into the main drains which flow into a tank not used for drinking purposes. What becomes of it? Would it not be advisable to try application of it by irrigation as a temporary remedy till the town is drained?

33. The town of *Eroda*, with a population of 9,864, may be adduced as an example among many others that a good water-supply by itself is no sufficient protection against cholera. Its death-rate in 1883 was 29·9 per 1,000. It lost 71 of its inhabitants by cholera, a rate of 7·1 per 1,000. Its water-supply is reported as "good and ample, obtained chiefly from wells, a tank, and a magnificent "aqueduct." But cesspools exist, the town is undrained, and its epidemic liability is very high. In 1883 the total registered deaths were 295, of which 71 were due to cholera as already stated, 86 to small-pox, 45 to fevers, and 37 to bowel complaints.

There is no question, in a case such as this, about the effect of bad water; nobody denies the injurious influence of polluted water on health. The danger does not, however, lie wholly in this direction, but, on the assumption that impure water is somehow a specific cause of cholera (or as some assert the sole cause of cholera), which, if acted on in the present case, would leave Eroda just as it is, and its people liable to cholera and other epidemics.

34. In the same district is *Karur*, a town of 9,205 inhabitants, which had a total death-rate of 51·6 per 1,000, half of which, or 25·2 per 1,000, was due to cholera. The cholera deaths in this small town were 232 in number. Those from small-pox 16, from fevers 55, and from bowel complaints 53, making together 356 epidemic deaths out of a total mortality of 475. Now in this case the element of pure water was absent. It is obtained "from the river, public and private wells, and two irrigation "channels. Some of the private wells are situated close to the privies. No improvement appears to "have been made in the conditions of the two irrigation channels noted last year; they are in the "same insanitary condition, and subject to all kinds of pollution."

This might give weight on the side of the cholera water theory were it not for the Erode experience and for the presence of these other facts about Karur:—"Drainage unsatisfactory and defective. There "is no regular system. Only one masonry drain exists, with a cistern at either end, and the contents "of which are carted away and thrown on the river bank. These cisterns always overflow, and are "a great nuisance. Drainage of houses also is defective." Karur appears to require sanitary work of all kinds, and when cholera came round it easily found a locality.

35. Cholera was prevalent in *Coimbatore* district, within which these two towns are situated, and its cholera death-rate was 2·0 per 1,000. The corresponding rate, as we have seen for Eroda, was 7·1 per 1,000, and for Karur 25·2 per 1,000. The simple facts appear to carry with them their own practical lessons. Impurity of subsoil was present in both cases as the fundamental localizing condition of cholera, and in the Karur case the local evils appear to have been added to by bad water. Experience in England has been similar to that of India. To prevent cholera single remedies do not necessarily answer, but there appears to be a prime necessity for an all round improvement, such as a cleansed site, cleansed and ventilated tenements, personal care and cleanliness, protection from the weather, wholesome water, wholesome food. Bad water alone does not necessarily produce cholera, nor do sewers and drains prevent it, if the site remains impure, the tenements foul, overcrowded, and unventilated, and their surroundings filthy. Nothing short of general care and all round improvement, especially in cleanliness, can be relied upon permanently to reduce disease.

36. *Madura* is one of the most populous towns of the Presidency, and contains 73,807 inhabitants. This town possesses some epidemic interest, as one of the points from which the great cholera invasion that reached England in 1848 took its departure. Madura district, in which it is situated, yielded a cholera death-rate in 1883 of 2·0 per 1,000, or four times the previous five years' average. The town itself had a death-rate from cholera of 11·2 per 1,000, and a death-rate from all causes of 37·5 per 1,000. It has hitherto been deficient in all sanitary requirements for so large a population, and "the "river Virgai, the chief source of drinking water, as it enters the town receives the drainage of a "burial ground, and its bed is used as a latrine all the year round, and persons, cattle, and filthy "clothes are washed in it." To remedy this great evil trial wells have been dug at safe points in the dry bed of the river, underneath which is a large flowing water-current that can be safely made use of by suitable arrangements for raising and distributing the supply. Drainage is still in an unsatisfactory state, although considerable improvements have been made. "It will take some time "to work out a satisfactory system of drainage for so large a town as Madura, but it is fairly begun, "and, if prosecuted with the same energy, Madura, before many years, will be a well drained town." Conservancy appears to be attended to, but, as the town is to be supplied with water, care should be taken to combine the new drainage with the water-supply, otherwise the added water, if passed into the subsoil, may become an added disease cause.

37. *Salem.*—This town has a population of 50,667, and its sanitary history for the year presents some peculiarities which are worthy of being inquired into. For instance, the death-rate of Salem district in 1883 was only 16·7 per 1,000, and its previous five years' average was 14·9 per 1,000. The town rate for the same year was 21·3 per 1,000, and for the preceding five years it was 20·3 per 1,000. But when we come to analyse the rate we are met at once by facts which appear to throw doubts on the registration, or census, or both. Thus we find that the rate of 1883 for the town was made up of 7·5 per 1,000 from cholera, 1·9 per 1,000 from small-pox, 3·7 per 1,000 from fevers, and 1·6 per 1,000 from bowel complaints, and thus 14·7 per 1,000, or above two-thirds of the mortality, were due to epidemic diseases. In the absence of cholera the year's death-rate would have been 13·8 per 1,000, and as regards fever, this epidemic town, if its statistics were reliable,

would take rank among the most healthy of all sub-tropical towns. It would appear as if improvement in the registration were required, as well as more active efforts to improve the sanitary condition of the houses. The drainage "is defective both of streets and houses; cesspools abound. The water "from the wells is somewhat brackish," a not unusual concomitant of cesspits. The only satisfactory statement on these subjects is that "the construction of drains parallel to the river is under con- "sideration," as is also "the improvement of water-supply and the introduction of artesian wells."

*38. *Tinnevelly.*—Population, 23,221. The registered death-rate in 1883 was 33·8 per 1,000, and the previous five years' average 36·1 per 1,000. Its cholera death-rate was 10·9 per 1,000, while that of the district was 2·6 per 1,000. The water-supply of this town is received through channels "subject to all kinds of pollution." "The Sanitary Commissioner during his visit to the town of "October 1883 found the road round the Minakolam tank frightfully defiled with human ordure, "and saw a large number of women washing themselves and their clothes in the tank." Drains are without "any systematic construction, hence the drainage of houses and streets is unsatisfactory; "numerous cesspools exist. Tinnevelly has not improved, but retrograded as regards cleanliness "since last inspection." We have in this town an example of high epidemic mortality, with an exposition of its causes. It has a municipal government which appears to have arrived at these results of its work.

39. A somewhat similar account is given of *Trichinopoly*, which has a population of 84,449. Its death-rate is a little over 23 per 1,000 on an average. It was 23·6 per 1,000 in 1883, but if this estimate were correct, by deducting 5½ per 1,000 for the cholera of this year, we should have a remainder of 18·1 as the rate exclusive of cholera. There appears to be some error in the returns, especially as the figures by no means correspond to the sanitary facts stated in the Report. For example, it is stated, as regards the water-supply, that "with all the measures adopted to prevent the "sources from pollution, contamination does take place, and the water is defiled in many ways."

Next, as to drainage, it is stated that "there is no regular system. Only the main streets and "principal bazaars are provided with open drains, often choked with all sorts of rubbish. The "backyards of houses are kept very filthy. Numerous cesspools exist."

The plea of want of funds ought not to be accepted as an excuse for such a state of matters. A year's loss of health for so large a population would go far, if saved, to pay for the required work. Besides, what is the municipality there for, if not to provide funds and apply them intelligently to the prevention of epidemics?

40. These instances, taken from the municipal reports, will illustrate the influence up to this time of municipal action on public health questions. Good in certain directions has no doubt been done, and in the majority of reports there are no specific allegations of neglect such as those we have discussed, but surely some more efficient steps should be taken to improve the larger towns.

41. *Local fund circles.*—There are 30 of these circles, which, for practical purposes, may be said to include all the population of the Presidency except that part which inhabits the towns. Among the circle populations all the real sanitary problems may be said to lie, and yet it is in country districts that funds are smallest in amount and sanitary requirements are most urgent.

The total expenditure for the whole year 1882–83 was as follows:—

	Rs.
Conservancy	160,678
Improvement of village sites	24,950
Water-supply improvements	75,980
Fairs and festivals	7,843
Other sanitary objects	45,414
Markets, &c.	34,656
Total	Rs. 349,521

Not much could have been accomplished with so limited an expenditure, and nevertheless the whole grant for sanitary purposes was not expended.

42. On this, the most important of sanitary questions, we can only repeat what we have often stated, that the epidemic susceptibility of Indian populations is due to the insanitary condition in which village populations live. Without going into details, which we have fully discussed in our suggestions, we may sum up the case in the following words.

Daily cleansing and keeping clean is the only method by which village subsoils can be kept from being used up. Neglect of cleanliness in times past appears to have led to the pollution of village sites and the sources of village water-supply. These unhealthy villages cannot be removed to new ground, and all that can be done is to stop the sources of further subsoil pollution, by observing strict cleanliness, and by simple surface drainage, filling up holes, and the like. If this be done, time will cleanse the subsoil, and the liability to epidemics will decrease, but in the meantime the unwholesome water-supply ought to be remedied. Of course these great improvements would require time if considered as a whole, but this difficulty would cease if each village were separately dealt with, for the whole matter is in reality a single village problem, and there are village officers in existence whose services might be called upon to solve it.

43. The Sanitary Commissioner reports that there is increased activity visible on the part of town municipalities, and this, so far, is satisfactory. We are also disposed to concur in the view that there

is a certain amount of progress manifested by the reports, and also by the mortality statistics. The jail experience is very hopeful, as showing that efficient improvements in the public health are as possible in Madras Presidency as elsewhere, and we must leave the matter in the hands of the Government, to take such steps as may be practicable to remedy the acknowledged evils.

44. We may state, in conclusion, with reference to the degree of importance in the water question which the Sanitary Commissioner appears to attach to the supposed "cholera bacillus," that no sufficient proof has been adduced to show that this microphyte is peculiar to cholera or to water consumed by persons living in cholera localities, or that it is the cause of cholera; while, even if the assertions were accepted as true, this would lead to no modification in the sanitary improvements required for cholera localities, simply because the bacillus itself requires certain conditions for its cultivation, and these are the same as exist in the impure water of affected localities. It follows that, even if the bacillus were proved to merit all the importance which has been claimed for it, it could not be dealt with otherwise than as an additional proof of the necessity for local sanitary measures, which moreover, is obvious enough already.

24th July 1885.

No. 3.

Memorandum of the Army Sanitary Commission on the Report of the Sanitary Commissioner of the Government of Bombay for 1883.

In our Memorandum on the Report of the Sanitary Commissioner for 1882 we gave the population and other details for each district in the Presidency. It is not necessary to repeat them in the present memorandum, and we shall deal with the returns as a whole.

1. According to the census of 1881 the population of Bombay Presidency, with the military included, was,—

Males	8,497,718
Females	7,956,696
Total	16,454,14

The average population per square mile for the entire area was 132·85. But the population density differed greatly in different districts. The most sparsely peopled area was Thar and Parkar, which had about 16 inhabitants per square mile, and the most densely peopled district was Kaira, which had 500 to the square mile.

2. The births among the population in 1883 were, of—

Males	261,966
Females	239,835
Total	501,301

= 30·50 per 1,000. The previous ten years' average birth-rate had been 21·35 per 1,000, and all that can be said about the figures is that the registration is improving, and that the rate for 1883 is nearer the truth than the rates of previous years. The lowest birth-rate of 1883, namely, 15·92 per 1,000, was registered in Hyderabad, and the highest, 44·09 per 1,000, in Dharwar. The district tables appear to show that registration of births is better done in some districts than in others.

The subject of birth registration is fully discussed in the Report, but the general results are all that we need notice.

3. The deaths in 1883 were as follows:—

Males	221,110
Females	199,088
Total	420,198

= 25·53 per 1,000 of the population.

The annual registered deaths since the famine years 1877–78 have been:—

Years.	Deaths.
1879	337,542
1880	328,673
1881	381,450
1882	343,418
1883	420,198

These annual figures appear to show that death registration is better carried out as a whole than the registration of births, although the district returns yield evidence that the work is better done in some areas than in others. Thus in 1883 Upper Sind frontier district yielded a death-rate of 9·19

per 1,000, which may be left aside. But we have for Hyderabad and Karachi death-rates of 14·47 and 14·98 per 1,000 at one extremity of the scale, and Khandesh at the other with a death-rate of 41·97 per 1,000. Discrepancies such as these can only be equalized by greater care in record.

4. The following per-centages of deaths at different ages may be here introduced, because they are arrived at from deaths actually registered :—

Ages.	Per-centage of Total Deaths.
Under 1 year	21·35
1 and under 5	19·19
5 „ 10	5·90
10 „ 15	3·46
15 „ 20	3·84
20 „ 30	9·98
30 „ 40	9·52
40 „ 50	8·20
50 „ 60	8·18
60 and upwards	10·38
Total	100·00

It appears from this abstract that 40·54 per cent. of the total deaths in 1883 took place at ages under five, a fact which by itself is an index to the defective sanitary state of the people.

5. *Causes of mortality in* 1883.—The next abstract gives the causes of mortality for a period of 11 years :—

Death Causes.	1883.		Mean of 10 Years, 1873 to 1882.	
	Number of Deaths.	Ratio per 1,000 of Population.	Number of Deaths.	Ratio per 1,000 of Population.
Cholera	87,954	2·31	21,621	1·33
Small-pox	13,404	·81	6,522	·40
Fevers	266,741	16·21	255,531	15·70
Bowel complaints	35,292	2·14	33,150	2·04
Injuries	5,978	·35	6,440	·40
All other causes	60,829	3·70	68,270	4·19
All causes	420,198	25·53	391,534	24·06

This table shows that the deaths from all causes registered in 1883 exceeded those of the previous 10 years' average by 28,664, equal to a ratio of 1·47 per 1,000 in excess, and when we analyse the causes it becomes at once evident that the excess is due solely to the greater prevalence of epidemics in 1883, during which year the deaths from cholera exceeded those of the 10 years' average by 16,333, the small-pox deaths by 6,882, the deaths from fever by 11,210, and those from bowel complaints by 2,142 deaths. The excess of epidemic deaths in 1883 over the average was thus 36,567, while the excess from all causes in 1883 over the previous 10 years' average was 28,664. The difference between the two sums represents 7,093 fewer deaths from accidents and all other causes registered in 1883 than in the previous 10 years' average.

The practical conclusion, therefore, is that there was a great augmentation in epidemic susceptibility among the people in 1883, a sure proof that sanitary work has not yet reached its causes, and pointing at the same time clearly to the sanitary measures required, and the urgent necessity of taking them in hand without delay.

6. We have already seen that the district which yielded the highest death-rate of the year was Khandesh. The rate was 41·97 per 1,000, and we shall select this case as an illustration of how, in such cases, the death-rate is composed, and how, when sanitary work has not been done to diminish the epidemic susceptibility of the people, enormous losses of life may come very suddenly.

The population of Khandesh in 1881 was 1,287,231. Its mean death-rate for 10 years had been 22·48 per 1,000, and in 1882 the rate was nearly the same, 22·97. In 1883 it was nearly doubled, a result due to the causes which follow. Its average loss from cholera during 10 years had been 1,747 deaths, or 1·63 per 1,000 of the population. In 1882 there were only 135 deaths from this disease, or 0·11 per 1,000. During January, February, March, and April 1883 there was no forewarning of the coming epidemic, which suddenly swooped down on the people in May and carried off 882 of them; in June there were 2,824 deaths; in July 5,214; in August 2,420, when the epidemic suddenly disappeared, there having been only 71 deaths in September, and three in November. All the 26 registration circles were affected, and 764 villages out of 2,660 furnished the deaths, which, from first to last, numbered 10,914, or 8·82 per 1,000 of the population. We are now in a position to state that, although we know not what epidemic cholera is, we do know that it manifests its presence locally, and that by changing the character of the locality it ceases to do so. If these 764 unfortunate villages had been dealt with on the same principles as have been applied elsewhere in India, we should have had every reason to have anticipated that much life would have

been saved. The excess of the cholera death-rate in 1883 over the previous 10 years' average was 7·19 per 1,000, so that without this epidemic outburst the total death-rate of the year would have been 34·78 per 1,000.

7. But cholera was not the only epidemic from which the excess of mortality took place. The 10 years' average small-pox deaths were 860, or in the ratio of 0·83 per 1,000. In 1883 these deaths were 2,345, or 1·90 per 1,000. Again, the annual fever deaths which yielded a 10 years' average of 16,945, or 15·82 per 1,000, was represented in 1883 by 30,569, deaths, or 24·71 per 1,000. Lastly, the bowel complaint deaths, which on a 10 years' average gave a ratio 3·15, rose in 1883 to 5·14 per 1,000.

These epidemic diseases, taken together, gave rise to an epidemic death-rate in 1883 of no less than 19·11 per 1,000 in excess of the previous 10 years' average, and now we have the great general death-rate of Khandesh fully accounted for. Without the excess of epidemic mortality the death-rate of this district for 1883 would have been, not 41·97 but 22·86 per 1,000. Before our practical knowledge of sanitary work and its results became what it now is, the reply on the whole case, would possibly have been that this great mortality was simply due to epidemics. No such reply is now possible. The severity of epidemics is determined by the nature and extent of insanitary conditions, and if there be executive sanitary authorities to deal with these conditions, epidemic death-rates mark the extent to which these authorities have discharged or not discharged their duties.

8. We shall next give some account of the epidemics of the year in the Presidency, beginning with *cholera*.

The five northern districts of Bombay Presidency, including Sind, escaped cholera altogether in 1883. They were out of range of the epidemic. Of the western districts, Ahmedabad, Broach, Panch Mahals, and Kaira suffered comparatively little, as did also Dharwar, Kanara, and Ratnagiri.

The real epidemic covered the central and eastern districts of the Presidency, and the monthly mortality returns show that the outburst of cholera in Bombay Presidency followed the same time law as the epidemic outbreaks in the Central Provinces and the Berars. The whole constituted in fact, a single epidemic area, within which cholera was almost absent until April and May; and during the subsequent months cholera gave rise to great mortality, until near the end of 1883, when it subsided over the whole affected provinces. Many hundreds of square miles were attacked simultaneously in all the provinces, and in all of them it ceased at the same time. In 1883 they formed one distinct continuous epidemic area.

In other memoranda we have given brief abstracts of cholera history for the Central Provinces and the Berars, but it was necessary to show the relation of the facts to those which presented themselves at the same time in Bombay.

9. The year's mortality from cholera in Bombay was made up of 34,919 deaths in the country districts and 3,935 in the 62 towns, in all 37,954, giving a death-rate of 2·37 per 1,000 for the districts, and 1·87 for the towns. The rate for the whole population, affected and unaffected, was 2·31 per 1,000, but the cholera death-rates varied from zero up to 9·81 per 1,000, the highest rate of the year, in Ahmednagar district. There are 285 registration circles in Bombay Presidency, in 174 of which deaths were registered. But the outbreaks were purely local, and were confined to 3,200 villages out of 24,431. Likewise, out of 62 towns 43 had deaths and 19 escaped.

10. The monthly prevalence of the epidemic was as follows:—

Months.	Cholera Deaths.	Months.	Cholera Deaths.
January	28	July	12,708
February	1	August	6,783
March	18	September	1,230
April	936	October	895
May	5,622	November	340
June	9,447	December	146

The statistics present no evidence of spreading from a centre or centres.

The epidemic in its action resembled that of an intervening force, falling on detached population groups, and leaving the other groups free for the time at least.

11. The next abstract shows the annual cholera mortality in the Presidency for a period of 18 years.

Years.	Cholera Deaths.	Years.	Cholera Deaths.
1866	23,027	1875	47,555
1867	5,143	1876	32,117
1868	6,841	1877	57,252
1869	52,330	1878	46,743
1870	2,666	1879	6,937
1871	5,231	1880	564
1872	15,642	1881	16,694
1873	283	1882	7,904
1874	37	1883	37,954

The famine and scarcity years 1877–78 show the highest death-rates, otherwise the data show a two years' period of lower mortality followed by periods of augmentation. As a simple matter of fact, and without any theory, there is an appearance as if time were an important element in the question of predisposition when the epidemic period comes round. It is very much to be regretted that, even allowing for the great epidemic mortality of the famine years, this abstract shows no indication of falling off in the liability to cholera. The conclusion of course is that, whatever sanitary work may have been done in the villages, it has not yet reached the causes of epidemic localization. There are circles which show death-rates of 3 per cent. from cholera alone, and all that can be said is that there must be removable causes for fatality such as this.

12. Some interesting facts are stated about the town of Nasik, where there were 428 deaths from cholera, or 17·76 per 1,000 of the population. The town contains 3,745 houses, of which 546 or 14·58 per cent. were invaded, besides temples, mosques, &c. The Assistant Sanitary Commissioner states that the per-centages of attacked floors in these 546 houses stood as follows, ground floors 48·93, one storey 46·78, two stories 3·97, three stories 0·33, and he concludes from the figures that "the "nearer the ground or the lower in every respect the type of house, and of perhaps its inhabitants, "the greater its susceptibility to cholera." He further describes the attacked places as follows:— "I have seen buffaloes, cows, ponies, and goats housed round the chowk (open space in centre of "house), sharing such quarters with lodgers or servants. Its faulty drain is apt to and sometimes "does become choked, and then a nuisance arising from the combined accumulation of animal "excreta and house filthy water is very objectionable. In a certain chowkless cholera-smitten house "the ground floor was occupied by cattle, and more resembled the interior of a neglected pig-stye "than a place of human abode. Overhead cholera appeared."

In another like instance a buffalo and a cholera patient were lying side by side in the same compartment on the basement.

Other similar details regarding cholera affected houses are given, and they can only lead to expressions of regret that in a town under any form of municipal government such neglect of the true interests of the people should be possible.

The remedies proposed by the Assistant Sanitary Commissioner and sustained by Mr. Hewlett are, "a new water-supply, improved drainage, and a better system of practical sanitation throughout the "town." The Assistant Sanitary Commissioner states the two following cases as facts. While cholera was very severe in a particular section of Nasik, the water for which was taken from the Godaveri opposite the Kekti gate, the place of supply was shifted higher up the river, and "a decline "in the number of attacks on that area was at once most marked." The other fact relates to an outbreak of cholera amongst poultry venders encamped in diminutive grass huts, which "completely "disappeared on the removal of their abodes *en masse* some 200 yards in a south-west direction in "the very teeth of the monsoon." This was simply an experiment on the influence of unclean locality on cholera, which took itself away, or rather was left behind when the subjects, the people, were removed out of it.

13. Besides these specific cases the Report contains full statistical details for each district, but there is nothing in them which calls for special remark on sanitary grounds, except that the whole history is one of localized cholera attacks, the general causes of which are quite well known, while so far as concerns the village populations, there is no evidence that their high susceptibility to epidemics has been in any way diminished.

Mr. Hewlett has done his part in preparing instructions at the desire of the Government for the guidance of villagers with reference to outbreaks of cholera. But we must again repeat what we have often insisted on, namely, that an attacked village is already a cholera locality, with which little can be done except to leave it, and that the lesson furnished by all experience is that, when an epidemic disease breaks out among a group of people, the mischief arising from previous neglect has been completed, and that the time for effective work has passed away. In Mr. Hewlett's own words, "The people, at times when there is no cholera, should be warned that the surest preventive of "cholera is to have clean air, clean food, clean water, clean houses, and clean persons." But the "missing link" in this procedure is the want of some person or persons to see that the work is continuously carried on.

14. *Small-pox and vaccination.*—The following table shows the annual deaths from small-pox during the last 12 years:—

Years.	Deaths from Small-pox.	Years.	Deaths from Small-pox.
1872 - -	26,599	1878 - -	4,475
1873 - -	9,935	1879 - -	1,156
1874 - -	3,903	1880 - -	940
1875 - -	3,461	1881 - -	539
1876 - -	11,817	1882 - -	1,630
1877 - -	27,369	1883 - -	13,404
Total six years	83,184	Total six years	22,144

This table shows two important results in the past history of small-pox in Bombay. First, the disease is liable to epidemic increase and expansion. Second, the history in the second column varies greatly from that in the first, for it shows that, while the epidemic character is maintained, there has

been a great reduction in the mortality. We shall presently see what relation this lower death-rate bears to vaccination.

15. Small-pox deaths were returned from all the districts, with two exceptions, Shikarpur and Upper Sind Frontier. The total country deaths were 9,731, or 0·68 per 1,000. Of the 82 towns 49 were attacked, and yielded 3,673 deaths, or 1·74 per 1,000. The rate for the province was 0·81 per 1,000. Out of 285 registration circles 212 registered deaths; but out of 24,431 villages only 2,577 returned small-pox deaths.

16. The monthly incidence of the disease is shown in the following table:—

Months.	Small-pox Deaths.	Months.	Small-pox Deaths.
January	1,039	July	616
February	1,947	August	460
March	2,814	September	328
April	2,228	October	302
May	1,296	November	446
June	830	December	1,033

Of these deaths 4,544 took place in children under one year of age. Above one and under 12 there were 6,960 deaths, and 1,900 above 12 years.

17. The vaccination staff for the official year 1883–84 was as follows:—

Deputy Sanitary Commissioners	5
Superintendents of Vaccination	3
Inspectors of Sanitation and Vaccination	31
Assistant Superintendents	5
Clerks and karkuns	29
Vaccinators	464
Peons	489
Total staff	1,023

The vaccinations performed by this staff for the whole Presidency in the same official year 1883–84 amounted to 883,839. Of these 826,965 were primary vaccinations, and 56,874 were re-vaccinations. The successful primary operations were 791,323, or 95·69 per cent. of the whole. Of the re-vaccinations 37,657, or 66·21 per cent., were successful.

18. The relation of these results of vaccination to small-pox mortality might be estimated from the following data, if all the births were registered:—

Births returned	501,801
Died under 1 year	89,708
Considered available for vaccination	412,093

But as some of these deaths may have taken place from small-pox, we should be perhaps nearer the truth in assuming the whole number, or say half a million, as the available supply of children.

We have now to compare with this the aggregate successful vaccinations, which for ages under one year amounted to 307,358, or three fifths of the births. Again, the vaccinations between one and six years of age were 178,627.

We have already seen that one of 13,464 deaths from small-pox in 1883 the deaths under one year of age were 4,544, or a third of the whole year's loss, and it appears to follow as a practical conclusion that greater effort should be made to extend vaccination at ages under one year, for by doing so the absolute protection will be greater. But the last six years' mortality in the table given above shows distinctly that for some reason or other the deaths from small-pox have undergone a very notable reduction, and as the only apparent cause is the cumulative effect of vaccination at the rate of three-quarters of a million of operations a year, we are apparently justified in congratulating the vaccination department on this result of its work.

19. *Fevers.*—The following abstract gives the registered deaths from fevers during the last 12 years:—

Years.	Deaths from Fever.	Years.	Deaths from Fever.
1872	206,747	1878	357,876
1873	183,201	1879	286,526
1874	283,717	1880	246,779
1875	279,156	1881	272,493
1876	220,933	1882	245,156
1877	336,865	1883	266,741
Total six years	1,355,519	Total six years	1,673,279

If the fever diagnosis on which this table rests were reliable, we should have to admit a large increase of fever deaths of late years, but from what we know on this subject all that can be admitted is simply the fact that a larger number of deaths under this head have been registered.

20. Fever deaths were registered in all the districts and in all the towns. The fever death-rate for the former was 16·76 per 1,000, and for the latter 12·4 per 1,000. The rate for the whole Presidency was 16·21 per 1,000, and the previous five years' average was 17·26 per 1,000. All the 285 registration circles returned fever deaths, as did also 22,077 villages out of 24,431.

The highest fever-rate of the year, 24·71 per 1,000, was returned from Khandesh, and it is worthy of remark that the lowest rate of the year was returned from Bombay city, the dense population of which, amounting to 773,196, yielded a fever death-rate of 7·47 per 1,000.

21. The monthly fever mortality was as follows:—

Months.	Fever Deaths.	Months.	Fever Deaths.
January	23,513	July	23,176
February	21,114	August	23,703
March	22,869	September	20,755
April	22,385	October	19,144
May	20,512	November	23,787
June	20,700	December	25,153

22. There is an interesting fact stated about Sind which shows that epidemic death-rates taken over the whole population do not necessarily afford a correct idea of the facts. Deaths from all causes in Sind division were in the ratio of 15·16 per 1,000, suggestive of deficient registration, while the fever deaths in the same division amounted to an apparently low ratio of 11·42 per 1,000. But the Deputy Sanitary Commissioner calls attention to the real meaning of the figures, and it is this:—In 1883 there were 36,582 deaths from all causes in Sind, and of these no fewer than 31,558 were registered as fever deaths. The fact is not an insolated one, for in 1881 there were 27,575 fever deaths registered out of a total mortality of 31,914, and for 1882 the figures were 37,785 fever deaths out of a total of 42,337.

It appears that the tendency to death in Sind lies in the direction of fever, and it is accounted for as follows:—"The chief cause may no doubt be found in flooding the country by the river Indus. "The inundation of 1882 stands unrivalled. Vast tracts of land in certain districts were covered "four months with the water which overflowed from the canals. These districts became very "unhealthy, and severe fevers, resulting in a largely increased death-rate, followed." We have the means of checking this view of the case by comparison with the European troops for only two points in Sind, Hyderabad, and Kurrachee, but the numbers are scarcely large enough for the purpose. They are as follows,—Strength at two stations, 1,007. Deaths all causes in 1883 = 12, of which 3 or 25 per cent. only were due to fevers, instead of 86 per cent. as among the civil population. It may, however, be fairly inferred that a large proportion of the deaths in Sind is due to fevers. Formerly, we raised certain questions regarding the lower rates of the Indus delta, when compared with the rates in the delta of the Ganges. But the present data give a new aspect to the question. In 1883 the fever death-rate in Bengal was 13·81 per 1,000 for the delta regions; it is higher probably by three or four per 1,000, but the facts are not accurately known. Neither is the general death-rate known with much accuracy.

If we take the figures, however, as they present themselves, we are led to the conclusion that the population of Lower Bengal is a much less healthy population than that of the Indus valley, which moreover suffers very little from cholera while the Bengal population suffers much. But that, as regards fever, there is not that difference in favour of the Indus delta that was supposed. It is true that a weakly population has less power of resistance against malaria than a healthy one, but so far as malaria itself is concerned, it is no respecter of persons.

This is very old experience confirmed.

23. If the civil registration could be depended on to the same extent that the cantonment registration may be accepted, we should have a means of useful comparison between the two, affording results, certain of which would be satisfactory as showing improved cantonment sanitary condition, and some others the reverse.

An example or two will illustrate this point.

As already has been stated, Khandesh district had a reported fever-rate in 1883 of 24·71 per 1,000. Within this district is the cantonment of Nasirabad, whose fever death-rate in the same year was 28·60 per 1,000. The administrative sanitary question which these figures raise is obvious enough, and involves the sanitary improvement of the cantonment. The admission-rate among European troops in this cantonment was 1,941·3 per 1,000 from all causes, of which 1,042·4 were due to fevers. There was, however, only one death from remittent fever.

As an example on the opposite side we may take Poona, whose district death-rate from fevers was 16·08 per 1,000, while the cantonment rate was 7·50 per 1,000. From among European troops at this station there were 240·1 per 1,000 admissions from fever, and the deaths were two from enteric fever and two from remittent fever. The fever death-rate was 3·68 per 1,000. Data such as these are of much use in sanitary administration, because they show where money may be most usefully spent.

24. As regards the general fever death-rates given in Mr. Hewlett's report, it may be safely stated that their very amount shows that these rates are due to local rather than to general causes, and that the first and earliest remedies, which are also well known, ought to be applied in the villages.

25. *Bowel complaints.*—The mean deaths registered under this heading in 10 years have been 33,150 per annum. In 1883, the deaths were 35,292, and the monthly numbers registered were as follows :—

Months.	Bowel Complaint Deaths.	Months.	Bowel Complaint Deaths.
January	2,406	July	4,149
February	2,100	August	4,450
March	2,211	September	3,374
April	2,403	October	2,891
May	2,683	November	2,790
June	2,990	December	2,845

There is nothing in the year's history of this disease class calling for remark.

26. *Injuries.*—The deaths from injuries in 1883 were 5,978, below the preceding six year's mean, which was 6,430. Of these deaths, 2,713 were by drowning, 130 by poisoning, 179 by hanging, 355 by wounds, 95 by wild beasts, and 1,215 by snake-bites. The death-rate from injuries averaged 0·36 per 1,000 for the Presidency.

During the past five years, 7,563 persons have been drowned in wells, a fact which, as Mr. Hewlett says, ought to suggest the question whether nothing can be done in the way of covering the wells to prevent this loss of life, and, at the same time to protect so many domestic water sources from pollution. The answer is, of course, at hand, and it is that, under a proper sanitary administration for villages, accidents or suicides in wells ought to be prevented.

27. Under the head of *All other causes* there were 60,829 deaths registered, in regard to which nothing is known.

28. *Sanitary works (military).*—The actual outlay on sanitary works (military) during 1883 was Rs. 174,733, and of this amount Rs. 95,855 were spent on new Native infantry lines at Jacobabad, leaving about 7,880*l.* for sanitary work at all other stations.

This small amount was no doubt usefully spent in details of improvements, especially in flooring, water-supply, and simple draining operations.

At Neemuch 12 wells had been domed over, and the executive engineer states that he thinks this plan of protecting wells a mistake, because "it prevents the wells being cleaned out, and does not "admit of deepening by the dredge, and renders blasting impossible," and it does not prevent the water from the persons of the bathers falling back into the well.

There are other and better ways of protecting wells whereby every one of these disadvantages can be avoided. We have shown one simple method of doing this in our suggestions. Although the available funds for barrack improvements have been very small, so far as can be judged of by the lists, the amount appears to have been expended usefully as regards the health of stations. But far greater improvements are needed at several of the stations where fever is prevalent.

29. *Sanitary works (civil).*—Under this head is stated the year's income and expenditure in 163 municipalities, having a conjoint population of 1,881,519 within which sanitary work was more or less done in 1883. The total income for all of them was Rs. 2,710,952, and of this amount the outlay for conservancy was Rs. 1,148,902, or not far from 50 per cent.

We have already mentioned Khandesh district with its high epidemic susceptibility. In this district there are 19 municipal towns with a population of 150,535, and these towns spent Rs. 24,845 on conservancy, or about a rupee per annum for every six people. Was it worth while to spend it?

Besides conservancy, much useful sanitary work is being done in these small towns in the direction of improving the water-supply and drainage, but cesspools are still the usual means of house drainage adopted, and so long as this is the case there can be no security during epidemic periods.

The following substitute for drainage exists in Hyderabad, "There are 61 iron tubs in the city for "the reception of foul water, and seven galvanized iron swing donkey carts are constantly employed "in removing the foul water from them." This is certainly better than allowing the water, after being fouled by use, to drain into the subsoil, but it would perhaps be useful to keep an account of the daily cost of this operation and of the quantities removed, and how the water is disposed of.

At Ahmedabad 133,000 gallons of water a day are raised by steam pumps from the river Sabarmati, but the spot selected for the waterworks is at the lowest point of the town, and after the river has been fouled by washing clothes, &c. In this case the proceedings appear to have got into a wrong groove at the beginning, for the water after being raised passes through a filtering tank and is distributed partly by earthen and partly by iron pipes, so that the authorities clearly intended to supply pure water. The subject is being reconsidered, but any way money will have to be spent in providing a purer intake, and this might have been avoided by very ordinary technical knowledge, had it been available before the scheme was decided on.

30. *Local fund circles.*—There is very little information as to the sanitary condition or improvements in these circles, which ought to include all the civil population outside the municipal towns. The chief works of the year were well improvements, useful, no doubt, in their degree, but forming only a very small item in rural sanitary work.

31. Perhaps the most important section of the present Report is that on the Sanitary Commissioner's "Personal proceedings and general remarks." The first part of the section is occupied by a discussion on the present condition of Bombay flats with reference to the filling up of the area by town sweepings. The area to be raised is about 1,500 acres in extent, and at the date of the Report 72 acres had been reclaimed, but under such conditions as to give rise to great nuisance, and in the opinion of the Sanitary Commissioner to endanger health when the nuisance is greatest, which happens to be the case in the rainy season. Hitherto the work appears to have been done on no organized system, and there have been other agencies besides the filling in, which have tended to increase the nuisance, such as partial fillings in by private parties so done as to interfere with the natural outfall of the drainage; raising ground for railways by deep trenching on each side the roadway, whereby the drainage water stagnates and causes nuisance besides obstructing drainage; permitting actual sewage to run on the area; permitting rice cultivation; the state of tanks, &c., on the area. Then as to the material used, which ought to be only clean selected street sweepings, with as little of putrescing material as possible; nevertheless the material was found to contain refuse of beef, mutton, fish, vegetable market *debris*, night-soil, and during the rains about 200 cartloads of cowdung are deposited daily.

It will be seen that this proceeding, which is intended, when complete, to effect an important sanitary improvement, has been conducted in defiance of sanitary rule. One interesting fact is mentioned, namely, that 31 years after a part had been filled with town sweepings, pieces of hay, straw, &c., were distinguishable 5½ feet below the surface. In giving any opinion on this long contested subject, all we can do is to restate the principles of procedure, which are as follows:—

The material used should be clean, and without putrescible organic matter, but it is doubtful if ordinary street sweepings can fulfil this condition. The area should be filled so as to advance equally along the same line, and to an equal level on a surface raised to the required height above datum; allowance being made for partial contraction and subsidences, exits should be provided for the displaced water. When an area is completed it should be at once placed under cultivation, but in such a locality wet culture is quite inadmissible. For this purpose the practice of covering the filled in area with earth should be continued. Nowhere, but more especially in such a climate, should there be any building of habitations on the reclaimed area. The best use to make of it would be to devote part to dry culture, and part to tree and shrub planting and garden ground. For a great city like Bombay, part of the area would make a splendid public park.

32. The drainage of Bombay is still in a most unsatisfactory state, after so many years of deliberation. The original intention was to remove house sewage by house connexions with the main drainage scheme to the sea at Warli. But the following passage from the Resolution of the Government shows the present position of the scheme:—"The municipality are as yet far from the "realization of this scheme. The system of sewers is in process of construction, but over a large "area it has not yet been commenced. No house connexions have been made. The fresh water-"supply is confessedly inadequate for the purposes of conservancy." This system also meets with opposition in certain quarters as being alien to the habits of the people, and nevertheless we have in the present Report the following statement on the subject by the Sanitary Commissioner, who says:—"I may mention, in connexion with this subject, that I inspected the water-closets which have "been erected as an experiment in the Native town, and I have come to the conclusion that, with "a plentiful supply of water, they are a success. They were free from smells, and the Natives "have found no difficulty in using them. Of course they require supervision, but their immense "superiority over the Native privy must be acknowledged by every impartial observer."

33. The estimated population of Bombay for 1883–84 was 807,905, and the chief sanitary problems which it presents are how to cleanse the houses and keep them clean, and how to supply the people with water for all purposes.

It is nearly a quarter of a century since the subject was first dealt with, and the present position is that the town and houses are still undrained, and there is not enough of water. Calcutta has all its sewage system complete, and it has got its water-supply, and there is no reason apparently why Bombay, which has nearly double its population, should have so long lagged behind.

In their Resolution referred to, the Government set forth the necessity of getting the cleansing done somehow, if not in one way yet in another. But considering the great importance of Bombay as a centre of commerce, and its ever present liability to epidemics and to quarantines consequent thereon, nobody would object if Government were to interfere and do the necessary work if the Municipal Commission is inclined to waste more time.

34. The accounts show that in 1883–84 the outlay for the health department, mainly required for removing house filth by hand labour and carts was 84,000*l*. Let the cost of house cleansing be separated and capitalized, and it will be seen how large a capital sum would be in hand for permanent work.

35. The practical result of Mr. Hewlett's inspection is stated as follows:—"The improvements in "the city of Bombay which have taken place during the last 10 years have been many. Perhaps "no greater has been effected than the raising of the ground level in Khetvadi by filling it in. On "all sides I see places which I remember to have been sources of disease gradually being improved,

" but the town is still an Augean stable, and requires an immense deal to be done before it can be " considered as at all approaching a satisfactory condition. One of the greatest wants from a sanitary " point of view, after an additional water supply and the completion of the sewage scheme, is, in my " opinion, a Building Act."

This discussion properly belongs to our Memorandum on the Bombay Municipal Report, but the questions have a practical bearing on the proceedings of other municipalities in the province. After completing his inspection of the city, the Sanitary Commissioner visited other places, and he gives a list of these, with the following remark:—"It seems to me that, as a rule, in the smaller munici- " palities, the Commissioners do not consider it to be any part of their duty to make any inspections " whatever into the sanitary conditions of the towns they live in, and they almost invariably delegate " this important duty to the Municipal Secretary, who has, generally speaking, had no sanitary " education at all, and who trusts a great deal too much to the Muccadam."

Even under so imperfect an administrative system some work, no doubt, is done, but a better organization of the whole town sanitary service is obviously required.

36. That good can be effected in this direction is shown by the fact that there are cases in which good work has been done by Municipal Commissioners, and there is, moreover, a very remarkable sanitary report on the condition of the city of Ahmedabad, drawn up by Mr. Ranchodlál Chotálál, Chairman of the Municipal Commissioners, in consequence of the Government having sent him our Suggestions and Memoranda, in which we raised certain questions as to the high death-rate of the city and its causes.

The report is a model of its kind, and we must hope that it may serve as such for other municipalities. Referring to fevers, we had asked how it happened that the fever death-rate of Ahmedabad was 35·65 per 1,000, while that of Bombay was 8·29 per 1,000, and here is the Chairman's reply:—

" We have no system of drainage at all. Our rain-water finds its way towards the river by natural " water-courses, and for the house sewage water some of the houses have got cesspits, called khalcooas, " attached to them. These pits are dug close to the house, to the depth of 15 or 20 feet, and are so " constructed as to allow all the sewage water thrown therein to be absorbed through the bottom and " sides in the surrounding subsoil, and thus, where the cesspits are arched over to the depth of 5 feet " from the surface ground, the surface is apparently clean and free from any bad smell. The subsoil " of Ahmedabad being porous, the khalcooas water easily finds its way to the water-bearing stratum, " which is within a few feet of the bottom of the khalcooas. This khalcooa system fouls the water of " all the wells in the city, and makes it unfit for drinking purposes. It, however, keeps the surface " clean, although the subsoil is far from being wholesome." Again,—"There are thousands of houses " in the city where no provision of any kind is made for the removal of house sewage. They have no " cesspits of any kind, and the people residing in such houses must throw the house sewage in front " of their houses, to allow it to be soaked in by the ground, and as many houses are situated in narrow " lanes not exceeding 5 or 6 feet in width, and as the houses are high, the sun's rays would not reach " the soaking ground for more than an hour or two in the daytime. It is therefore easy to imagine " that great dampness and malaria must prevail in such locality. . . . We see everywhere on the walls " of all houses in the city for a few feet from the ground marks of decay in the bricks and chunam or " clay, as remarked at page 5 of the 'Suggestions.' This mark on the walls is called *loona* by the " Natives, and is the evident proof of the unwholesome state of the subsoil" (it is the leprosy of the house of the Jewish sanitary law).

Questions relating to the water-supply, over-crowding, drainage works, &c., are dealt with in the same enlightened manner, but the great interest of this report is in the additional light it throws on fever causes in Indian towns, and Mr. Ranchodlál Chotálál has rendered a great service to sanitary improvement by preparing it. We must hope that its statements may receive the most earnest attention of the municipality. Ahmedabad contains 124,767 inhabitants. Its average five years' death-rate had been 57·53 per 1,000, and 40·80 per 1,000 in 1883, and it had a fever death-rate of 24·25 per 1,000.

The foul soakage of the subsoil, the closely built unventilated town area, by which damp malarious air is diffused through the houses, and the rise of subsoil damp in the walls, which tends to convert dwelling rooms built above the ground level into cellars built below it, are the fever causes revealed in this Report. It is for the municipality to decide whether these grave defects of locality can be most effectually and economically dealt with by a general system of drainage, or by some other simpler method. Any way the subsoil must be dried, and an arrest put on the upward rising of foul damp into the house walls.

We are glad to learn that one of the Native Municipal Commissioners of Poona was preparing a vernacular pamphlet to spread information on these important matters among his countrymen.

37. The following facts have an important bearing on the subject of ground damp in relation to the health of troops. Mr. Hewlett states that after the infantry barracks of Ahmednagar had been vacated for 24 days, and no water had been used, he had the stone flooring taken up and a hole dug down to the depth of 4 feet, and that all the earth under the flooring was damp and foul smelling. The flooring had been laid on rubble masonry, which was also very damp and signs of dampness were found in the barrack room walls. Five out of the twelve barracks showed damp walls. The wash-houses adjoined the barracks, and it seems probable that water may have entered the subsoil in this way. He advises separate washhouses, and cementing or asphalting the floors. But besides this measure, it would be safe to raise the flooring so that an open air space might be left under the floor and the above asphalte. We fear that many other barracks in India would be found to present similar unwholesome conditions, the result simply of bad design and construction, and we have in these and

similar facts a sufficient explanation of the prevalence of fever. On a former occasion, similar defects in the position and drainage of wooden huts in the Crimea were to a large extent remedied and fever arrested by cutting away the ground so as to completely isolate the huts from surrounding subsoil by means of deep trenches, and by providing ventilation under the plank flooring where such existed. India barracks of this kind are merely a worse kind of wooden hut.

38. As this matter is of great importance in fever etiology in India, we desire to call special attention to the following facts, which show not only the presence of the fever cause, but its effects. In 1877 the Bishop of Bombay was attacked by remittent fever while residing in a house in Poona. He had to be removed to Bombay, where he recovered after a protracted illness. Shortly after the Bishop left the house some ladies attached to the mission came to live in it, and one of them occupied the same room, and her bed was placed on the same spot as that on which the Bishop's bed had stood. She was attacked and died of enteric fever. The Medical Officer could find nothing about the premises to account for the fever, but at last he had the floor taken up. The ground below was found to be very damp, and on digging down "the smell was so bad that he had to run away." This fever was clearly due to subsoil damp and filth, and the agency of a specific germ was quite unnecessary, while the observed cause leads directly to the remedy. The origin of the damp in this case was supposed to be the draining of bath-room water into the subsoil, through a rat hole, but our contention from the very beginning has been that barracks for European troops should be so constructed as to render such accidents impossible, and this view will have to be adopted in the end. It would be a useful proceeding to take up the flooring of every room in which a case of enteric fever has taken place, and while raising the floor to renew the ground below it.

There is a discussion in the Report on an old subject, the mussack, and the filth it communicates to the water. The only remark which appears to be called for on the subject is, that admitting the convenience of the mussack on the march, we are living at the latter end of the 19th century, at a time when the mechanical arts might possibly be able to provide a perfectly wholesome substitute for this very antiquated water reservoir, and one a very great deal more convenient.

40. We now come to that part of the Report which, considering the magnitude of the interests involved, is the most important, viz., the sanitation of villages, of which there are 24,431 in the province, each one of which may at any time become the centre of an outburst of epidemic disease. As regards one disease, Mr. Hewlett says, "The one great cause of fever throughout India is the "existence of dampness in an impure and foul surface and subsoil in inhabited areas." There are, as he points out, certain general malarial conditions common to the country, but the cause of fatal fevers are local, just as in the case of a cholera epidemic, which covers large areas, and yet selects its victims according to strictly local conditions. In the case of fever, the local causes are foul damp, and in the case of cholera they may all be included under one word, "filth," and the removal of these conditions may be said to include the whole village sanitary problem. Impure water has to be set aside, and good water provided, but this need is simply one of the results of subsoil fouled by the habits of the people.

Lately much stress has been laid on the fact that the evils can only be removed by education, which is partly correct, but, while generations are being so far improved as to see the need of attending to their health, the people, as Mr. Hewlett points out, are dying, and the working power of those who survive is much damaged, and the country impoverished. A mere statement of the case ought to carry its own remedy with it. That the work can be done is shown by the following examples. Dr. Chaucer, Deputy Sanitary Commissioner of the Southern Deccan Registration District, says in regard even to Native States:—"In some villages of the Native States in this district very strict orders "and regulations have been made. Prickly pear is cut down, and areas marked out for natural "purposes;" and Mr. Hewlett continues: "I, too, was much struck on my late tour with the very marked "difference between the sanitary condition of villages in British and those in Native territory. It "was remarked to me, 'Oh, in Native States we have a great deal more "hookum," much less law, "and no Accountant-General.' Allowing that this is so, still I cannot help thinking that these "measures, which are absolutely essential for the public health, can and ought to be carried out in "villages in British territory as well as in Native States." Of course they could, and the work ought to be done more effectually, but the facts simply show the want of a sanitary executive, after above 20 years of discussions and reporting. Were it necessary, additional arguments could easily be drawn from this Report to enforce this conclusion. But, in fact, the entire past history of Indian epidemics and of Indian villages shows—

1. That their sanitary state, and the local epidemic causes, have been long made out.
2. That the successive sanitary officers of the Presidency have done their utmost to bring the facts to the knowledge of Government.
3. That the villages are much in the same state as they were, and hence that epidemics of cholera and fever, with their following poverty may be expected to recur as heretofore.
4. That the time has arrived for converting all this knowledge to practical purposes, even if only a few villages were selected to begin with.

The sum and substance of this Report, as of others which have preceded it, is that an executive sanitary authority is urgently required to improve the health and working power of the Bombay Presidency.

6th August 1885.

No. 4.

Memorandum of the Army Sanitary Commission on the Report of the Sanitary Commissioner for Bengal for 1883.

1. The population element of the vital statistics of 1883 in the present Report is that of the census of 1881, namely, 66,163,884.

In previous Memoranda we have shown how this population was distributed over the districts of Bengal in connection with the two most important elements, the births and deaths in each district. It is therefore unnecessary to repeat the data for the present year, especially as the registration is still so imperfect that no reliable estimate can as yet be formed of the year's ratios either of births or deaths in any registration district. All that can be said is, that in some districts the work is better done that in others, and what the ratios really show is not the true sanitary condition of the people so much as the greater or less imperfection of the registration itself.

2. Properly speaking, there is no general birth registration, on account, apparently, of the difficulty attending it. Births are registered in 46 municipal towns only. These towns had a population in 1881 of 1,685,159, and there were registered in them the births of 19,872 males and 17,343 females, together 37,215, equal to a total birth-rate of 22·08 per 1,000 for the year 1883, a ratio palpably below the truth. Some town circles registered fewer than 10 per 1,000 births, the higher rates were between 20 and 30 per 1,000. In a few cases the ratios exceeded 30 per 1,000. The highest rate of the year, an exceptional one, was returned from Jamalpore, namely, 49·17 per 1,000. Many of the town circles have populations too small to afford reliable results, and the ratio of 22·08 for the whole of them may be taken as representing the work done in this branch of vital statistics, and it fell short of the death registration by no less than 7·87 per 1,000, so that, apparently, a third more people died in the towns than there were children born to replace them.

3. Registration of deaths is conducted in some way or other in 648 circles, included in 45 districts, and the returns for 1883 showed that 676,175 deaths of males and 569,501 of females had been registered, 1,245,676 in all, showing a registered death-rate of 18·82 per 1,000, about 2 per 1,000 above the previous five years' rate, which was 16·75 per 1,000. These ratios are probably not much more than half of the true rates. District death-rates vary even more than do town birth-rates. The lowest death-rate of the year, 9·93 per 1,000, was returned by Monghyr district, which has a population of nearly two millions; the highest rate, 36·07 per 1,000, was registered in Nuddea, where the people have been suffering from fever. As a whole, however, there is less difficulty in death than in birth registration, but neither branch can be said to be in a satisfactory condition. The reasons of this circumstance are well known to the authorities, and strenuous efforts are being made to secure greater accuracy in the returns, but it is not possible as yet to adopt the local registration machinery whereby the work is more successfully done in this country. If there has been no increase of accuracy in the Bengal registration, there has been increase of area and population under the registration, such as it is.

4. *Causes of death.*—The following deaths were registered under the usual heads in 1883:—

Diseases.	Total Deaths.	Death-rates per 1,000 of Population.
Cholera	90,439	1·36
Small-pox	9,714	·14
Fevers	913,766	13·81
Bowel complaints	55,270	·83
Injuries	23,670	·35
All other causes	152,817	2·30
All causes	1,245,676	18·82

Divided between the town population of 2,469,163 and the country population of 63,694,721, the death-rates were as follow:—

Diseases.	Ratios per 1,000.	
	Towns.	Country.
Cholera	3·64	1·27
Small-pox	·27	·14
Fevers	13·77	13·81
Bowel complaints	3·54	·73
Injuries	·40	·35
All other causes	5·64	2·28
All causes	27·28	18·49

It will be observed that under all the heads except "fevers" the country registration is far more deficient than that of the towns. For reasons often stated, the fever registration is untrustworthy Cholera deaths are better reported, and their rate was nearly threefold greater in the towns than in the country circles. The country registration of "bowel complaints" and "all other causes" shows in what particulars this branch of the service was most defective in 1883.

5. We shall next give a brief sketch of the year's epidemic history, beginning with cholera, in regard to which we shall quote Dr. Lidderdale's opening statement:—"The disease was present in all "the 648 registering circles in the province, excepting 46, prevailing epidemically in only 47, against "115 in 1882; severely in 64, against 118; and mildly in 491, against 376; and it attacked only "6·55 per cent. of the villages, against 10·98 per cent. The casualties amounted to 90,439, and the "death-rate to 1·36 per 1,000 of population. The reduction on the figures of 1882 being 91,913 "deaths, or at 1·39 per 1,000, and on the average of the lustrum 1878–82, 16,107 deaths, or at "·25 per 1,000." Cholera deaths were reported from 16,416 villages out of 248,751 in the province.

Cholera was thus present over the entire area of the province in low intensity, shading away to nothing over a few areas, with increase in others, but only reaching 4 per 1,000, or a little over this, in two districts out of 45, the important fact being that whereas in 1882 there were 182,352 deaths, the loss of life in 1883 amounted to less than one-half of this number.

6. We shall next compare the monthly incidence of cholera during the two years with the rainfall of 1883.

Months.	Cholera Deaths.		Rainfall, 1883.
	1882.	1883.	
			Inches.
January	8,947	10,675	·69
February	7,588	4,702	·46
March	15,892	6,777	1·51
April	25,587	11,021	2·40
May	27,544	13,187	4·65
June	29,858	11,369	13·60
July	18,125	8,935	14·30
August	12,912	6,994	12·04
September	5,064	2,613	6·72
October	6,756	2,289	·29
November	12,357	3,725	·12
December	16,714	3,432	1·36

* This abstract gives the cholera history of Bengal for 24 months, and as will be seen this period includes three great epidemic outbursts of the disease, the first between March and August 1882, the second between November 1882 and January 1883, and the third from April to August 1883. The same months also include four periods of decline. These facts belong to a series which might be extended backwards as far as the statistics reach, and they afford conclusive evidence that besides any constant causes which may exist over these cholera areas there is some other cause altogether which increases enormously in activity during certain months, and declines in activity in others. There is one variable cause shown in the table, the rainfall, which has had a very considerable influence on the mortality of both years, for it will be observed that, as usually happens, the dry months are attended and followed by increase of cholera, which declines after heavy rains. This influence is visible in the statistics of both years, but it would in no way account for the double mortality of the cholera months of 1882 over the same months of 1883. It need scarcely be said that no known facts about cholera microbes, contagion, or any other such assumed causes, could account for them.

7. The sanitary fact shown by the table is, that heavy rain, which cleanses surfaces, flushes watercourses, and cleanses and replenishes the water of tanks and wells, reduces greatly the local liability to cholera. And we know that similar results follow from artificial operations of cleansing and water-supply during epidemics.

8. As illustrations of this rule, we may cite the comparative exemption of fairs at which sanitary precautions were adopted. No doubt the epidemic was not severe, and the question of intensity has always to be taken into account, alike in places where there was little cholera, and in places where it showed itself in severity in estimating the influence of sanitary precautions on mortality. Take, for example, the Gunga Sagor fair held in 24-Pergunnahs in January 1883. This fair lasted a week, and was visited by 98,500 people, among whom there were 34 cholera cases and 7 deaths, notwithstanding the adoption of "all needful sanitary arrangements." Did these measures then fail of effect? Such, apparently, would be the question to which, if other facts were ignored, an affirmative reply might be given, but it may be here stated, once for all, that no single observation such as this can determine the question. While the fair authorities are adopting their local measures and registering the results, cholera is following its own course, and this is being mapped out by the statistician, and the present Report enables us to complete our information, which makes a very material change in the reply to our question, for we find that in this same month of January there were in the 24-Pergunnahs, including the suburbs of Calcutta, 1,745 deaths from cholera, or nearly a fiftieth part of the whole mortality of the province. There were, in fact, only three districts out of the whole 45

with higher death-rates. This fact, of course, is a measure of local epidemic intensity, which, as we have often urged, must always be taken into account in deciding such questions, although the fact itself must necessarily be unknown in most cases until the epidemic statistical history has been worked out. Half facts of this class are the real sources of most of the disputes which have taken place about the manner of cholera movement in time and space.

9. There is a case of alleged importation into Thana Soori of a different character which the Medical Officer appears to have taken pains to follow out, but there is the same difficulty in accepting his conclusion, which would logically be village quarantines, in a country where the statistics show a very general prevalence of cholera. Soori is in Birbhum district of Burdwan division in the Ganges delta, not far from Calcutta. The whole area is a well-known epidemic region, and the seven districts, including Howrah, yielded more or less cholera mortality during every month of the year. The cholera deaths, excluding those in Howrah, amounted to 1,352, or 1·33 per 1,000 of the population, while the deaths in Howrah amounted to 1,909, or 3 per 1,000 of the population.

Birbhum district, where the importation case is alleged to have taken place, had no cholera deaths in January and September 1883. It had in all 297 cholera deaths in the other 10 months, or ·37 per 1,000. It was in the month of October, when cholera was absent from Soori thana, that cholera was supposed to have been imported from Burdwan district, where, be it remarked, there had only been eight deaths, during the same month of September, and 43 in October. The following is the history:—"A zemindar of Nagoree (in Thana Soori, population 705) in October, went on a visit "to a friend in Panagore, in the Burdwan district, and stayed with him for three days. In the "house, unknown to him, there had been two or three days previously some deaths from cholera. "On the third day of his visit he was taken ill with purging, and straightway returned home, where "the disease developed itself, and he died next day at his own residence. Three members of his "house got cholera in succession, after two or three days interval of each, and all but one "succumbed."

From this house it is supposed to have spread simply by communication to the adjacent village, and was carried elsewhere. An obvious defect in this statement is the absence of dates, which are of essential importance in such inquiries; and, besides these defects, there is another case which may show that there was some other reason for the alleged facts besides simple importation, but in this case also there is absence of dates. All we know is, that in the course of the year there were six deaths in Soori town. Among these were the deaths of the police magistrate and his two sons. They were in the habit of taking long rides in the sun, and drinking large quantities of iced buttermilk on their return. The house well was bad. All three were seized with cholera, and died within 24 hours after attack. Here there could have been no question of importation, and, quite apart from any such question, there was cause sufficient for the fatal results, in a district where the statistical history showed the presence of epidemic cholera at the time.

10. In this brief notice of these cases, we have had no desire to decide the questions at issue either one way or another. All such questions have two sides, the scientific and the practical. In sanitary work, the first is only of use in so far as it leads us to practical results, and, as these must lead to outlay of public or private funds, we are bound to challenge the evidence and to reject opinion, for it is certain that there have been statements put forth on matters of opinion in some reports the only logical issue of which would be the entire suspension of all human intercourse between affected and unaffected countries.

11. It is more satisfactory to refer to really practical statements as to the presence of very notable local causes connected with cholera outbreaks, because these, if turned to practical account, for all depends on their being so made use of, will help to save life. Thus, it is said of Burdwan population groups that "good drinking water is not available in many places, the majority of tanks which "abound in the district being in an extremely filthy state." In some towns in this district the death-rate was between 2 and 4 per 1,000, increased apparently in Ranegunge town by concourse of pilgrims to 6·76 per 1,000.

12. Sonamukhi town, in Bankura district, had a cholera death-rate of 5·70 per 1,000. The place is densely populated and filthy, "with numerous foul tanks and cesspools, and the magistrate says "that, until this state of matters is remedied, this tract will continue to be visited by the disease in a "virulent form." The magistrate did what he could in this case to protect the water sources from impurity, and in another similar case the same steps were taken, and the population suffered little from cholera.

13. In Midnapore district, villages which suffered severely "are particularly filthy, very densely "populated, and in great need of sanitary arrangements." In the littoral tract of this district, the magistrate states that there is almost everywhere a great want of good drinking water. Two thanas in this district, largely inhabited by Santhals, "who are far more particular than any other Natives "about the water they drink," suffered least from cholera.

14. An instance is given in Hughli district, where cholera broke out in a coolie depôt "without "latrines or sanitary arrangements of any kind." There were 17 deaths, and the disease ceased as soon as the unaffected coolies deserted the place.

15. In two villages within Calcutta municipality, "coolies congregate for employment during the "jute season, and there being no houses available, they put up rough temporary huts, in which they "live crowded together without any regard to sanitation."

These people generally yield the first cases of the disease.

16. Another outbreak took place at Kanchrapara among coolies proceeding to Assam, and among the railway workmen there, as well as in surrounding villages. "The affected localities were stated "to be extremely filthy, defecation being carried on anywhere and everywhere, and the water-"supply from tanks and railway cuttings very bad."

Discussions about importation of cholera in the case of another population group in certain villages opposite Chinsura were very properly dealt with by the municipality sending people to clear the jungle and drains, and serving notices for tank cleansing and removal of filth.

17. Cholera appeared in the Darjiling tea gardens, some of it at 7,000 feet above the sea. The Medical Officer states that "in all cases that came under his personal observation, the disease "appeared to break out in places where some local insanitary condition existed, such as accumula-"tion of filth, overcrowding, contaminated water-supply,"—such examples are cited,—"but in no "case did he notice a tendency of the disease to spread to other persons than those living under the "peculiar conditions which seemed favourable to the development of cholera." But in this case, as in others, there was the usual apparent anomaly of bad localities escaping.

18. The following examples in Dacca are cited by Dr. Crombie to show that something more than importation of cholera infection is requisite for its propagation:—"A severe outbreak of the disease "occurred at Keranigunge, on the opposite side of the river from Dacca. At this outbreak it was "observed that, although there is the freest communication between this place and Dacca town, "ferry boats conveying clerks and others constantly plying between the two places, Dacca was "comparatively freer from the disease." A similar fact is stated regarding Naraingunge, the great jute centre of Eastern Bengal, which had 29 cholera cases only, although in direct communication with severely affected places.

19. Another illustration may be cited from Gya district, because the various elements bearing on questions of cholera outbreak are considered. In Aurangabad thana the cholera death-rate was 7·22 per 1,000. The disease began in Aurangabad subdivision, and extended to others in the vicinity. "The Civil Surgeon visited many of the affected localities, but could obtain nothing but negative "evidence as to the causation of the disease. In no instance, however, was it to be traced to "importation. It appeared to him that the disease spread, irrespective of lines of traffic, and that "the prevailing winds did not influence its course; but that rather, while during the earlier part of "the outbreak, the prevailing wind was west, the progress of the epidemic was from east to west. "Mr. Skrine, the magistrate, is inclined to believe that the progress and virulence of the disease was "fostered by the filthy habits and overcrowding of the population."

20. Two towns in Gya district, Gya and Daudnagar, yielded very high death-rates; the former, 8·85 per 1,000, and the latter 23·20 per 1,000, the greatest death-rate of the year. It is very probable, as the magistrate states, that inattention to sanitary measures was an aggravating cause of this outbreak.

21. Poori town, the great pilgrim centre, had only 169 cholera deaths, or 6·95 per 1,000. Poori district had a cholera death-rate of 1·26 per 1,000, against a previous five years' average of 3·97 per 1,000, a fact which shows that cholera intensity is due to some other element besides the pilgrim element, and this experience is not without interest in connection with diminished cholera mortality, in cases such as Cuttack, for example, in which the lower mortality of 1883 over that of 1882 is attributed to obliging pilgrims to pass the town by a road two miles away. It is reasonable to believe that prevention of overcrowding and filth by this measure may have lessened the amount of cholera, only the whole history should be allowed for at the same time.

22. The practical result of the cholera experience in Bengal during 1883 confirms that of all previous years. We know nothing of the real disease cause. This varies in intensity, so far as can be estimated by the death-rates in different years and in different localities, and the conditions which appear to affect the local mortality most markedly are those which may all be classed under the head of defective sanitation, such as filth, bad water, crowding of dwellings and villages permanently and temporarily by influx of pilgrims or other passengers, and these causes of augmented local mortality point to the required remedies.

23. *Small-pox.*—Deaths from small-pox amounted to 9,714, equal to a death-rate of ·14, or half the mortality of the previous five years, which averaged ·29 per 1,000. The town mortality was ·27 per 1,000. Small-pox deaths were returned from all the 45 districts, with the single exception of Bogra, showing the very general prevalence of the disease; but, as usually happens, there were large areas in each district exempt. This is shown by the fact that only 364 circles of registration out of 648 returned deaths, while the total year's mortality was reported from 4,323 villages, and 244,428 villages had no small-pox deaths. The deaths per attacked village averaged a little over two.

24. The monthly mortality was as follows:—

Months.	Small-pox Deaths.	Months.	Small-pox Deaths.
January	844	July	729
February	1,280	August	454
March	1,560	September	243
April	1,478	October	161
May	1,348	November	218
June	906	December	498

The highest death-rate of the year, 94 per 1,000, was returned from Poori, which usually yields the highest rate.

It is worthy of notice that out of the total small-pox mortality of 1883, amounting to 9,714 deaths, 1,883 took place in children under one year of age, and above half the deaths were returned in children under 12 years.

25. *Vaccination.*—The vaccination staff of the year was constituted as follows:—

Superintendents	8
Deputy Superintendents	11
Native ditto	5
Inspectors	67
Head vaccinators	24
Vaccinators of Circles	268
Ditto, municipal and dispensary	224
Apprentices	57
Licensed vaccinators	952
Total staff	1,616

The total vaccination work of the year was represented by 1,361,332 operations, of which 1,350,519 were primary, and the remainder secondary. Of the primary operations, 98·66 per cent. were returned as successful, and of the secondary operations 49·42 per cent.

Successful vaccinations, according to age, were as follows:—

Under one year	178,487
One year and under six	877,338
Above six years	269,028
Total successful	1,324,853

26. The most important element in vaccination statistics, so far as concerns saving of life, is the age at which the operation is performed, and it cannot be said that the results for 1883 are altogether satisfactory.

Thus the births, estimated at 30 per 1,000 of the population, ought to have amounted to 1,446,805, while the actual number of operations performed under one year of age was only 178,560, leaving 1,144,153 unprotected (exclusive of 126,092 infants who died under one year).

Vaccination as a current protection against the ravages of small-pox ought to save lives in proportion to the numbers of successful results in the first year of age, and it would apparently follow, from the year's facts that most benefit to the State would be realized by directing the vaccination work so as to reach an annually increasing number of infants. At present the figures show that practically these special subjects of small-pox are left very inefficiently protected.

27. The average cost of each successful case of vaccination was 1 a. 7 p., and the total year's cost of the service was 13,127*l.*

The vaccination report contains ample information on the details of the year's work, but these are departmental, and do not call for remark. There appears to be a general state of apathy on the subject among the people, who afford very little voluntary help to the service.

28. In the present condition of the statistics, it is not possible to estimate the results to the public health. No doubt lives are saved, but the fact is obvious enough, that the most susceptible subjects, the infants, require to be more efficiently dealt with, before much impression can be made on this disease. With these cautions we shall give the following figures from the Report:—

Areas.	Population.	Small-pox Deaths per 1,000.
Thoroughly protected	26,155,179	·07
Fairly well protected	14,424,427	·17
Very partially and unprotected	25,987,792	·25

29. *Fevers.*—We have already given the fever mortality of 1883. There were registered more or less incorrectly under this head 913,766 deaths, or a death-rate of 18·81 per 1,000 of the population, fever deaths were returned in all the 648 circles of registration into which Bengal is divided. No doubt the diseases classed as fevers were universally prevalent, but fatal cases were returned from 42,731 villages out of a total number of 248,571. The fever death-rates varied greatly in different districts. The greatest rate of the year was 30·12 in Rajshahye, while in Orissa division the rates were from 5 to 7·85 per 1,000. In Burdwan district, formerly the seat of a very fatal fever epidemic, the death-rate was 23·35, or a little under the preceding five years' average. Burdwan division as a whole yielded a fever-rate of 14·34 per 1,000, a little over the previous five years' average, and the general average of the country for 1883. Nuddea yielded a death-rate of 27·60, against a five years' average of 30·20. This district, its fever mortality and sanitary condition, were reported on by a special commission, the result of whose work we noticed in last year's Memorandum on Bengal.

We have often discussed the causes and remedies for these Bengal fevers, but the subject is of such great importance to public interests that we shall continue the discussion by abstracting the facts on the subject in the Report under review.

30. The following table shows the relation of Bengal fevers to rainfall generally :—

Month.	Average Fever Deaths 1878 to 1882.	Fever Deaths, 1883.	Rainfall in 1883.
			Inches.
January	71,597	83,949	·69
February	55,921	65,425	·46
March	58,049	64,785	1·51
April	58,574	68,439	2·40
May	53,906	59,243	4·65
June	49,575	54,541	13·60
July	52,521	61,552	14·30
August	59,349	70,597	12·04
September	62,216	77,233	6·73
October	75,808	85,673	·99
November	93,156	108,885	·12
December	94,449	113,449	1·36

Generally, but subject to local exceptions, increase of rain influences the amount of fever only to a limited degree. The great increase takes place after decline in rainfall and the setting in of evaporation with lower and more variable temperatures. It is the same law which prevails all over India, and its results to health can only be dealt with by removing those conditions through which the rainfall acts. We shall next give an abstract of the local reports which define these conditions. The evidence is, of course, not new, but it is necessary to restate it year after year to avoid the danger which is so apt to arise from taking the facts as matters of course, whereas the entire Bengal problem is involved in translating these facts and their results in practical measures for protecting the people from epidemics and their consequences.

31. The Native Civil Surgeon of Bankura appears to have imported the doctrine of a fever germ and suitable soil into the question of fever causation, but it is only an inference drawn from certain facts, and the practical result is what the germ hypothesis always logically leads to, namely, that only the nidus can be dealt with and not the germ, and he concludes, "Where the moisture in the "soil owing to the proximity of a marsh, is perennially damp, there the fever prevails the most." A list of six thanas and towns in Bankura is given in which the fever death-rates vary from 19·75 to 27·86 per 1,000, and Dr. Ghose tells us as a matter of observation that the death-rates are proportioned to the dampness of subsoil.

32. In *Birbhum*, where the fever death-rates lie between 20·10 and 26·92, the Civil Surgeon says, "that to the dryness of the soil the lesser prevalence of fever may be ascribed, while, on the other "hand, prolonged dampness and moisture bring about the opposite condition."

33. In *Serampore* subdivision, it has been observed that increase of rain is associated with increase of fever. This result is possibly due to local conditions, because it is an exception to the general law already mentioned.

34. *Nuddea.*—In our Memorandum on the Report of 1882, we discussed at length the fever of this district, together with its causes, and we shall merely abstract the following general data from the Report under review to continue the history :—

Years.	Fever Deaths per 1,000 of Population.	Percentages of Villages attacked.
1880	26·11	96
1881	35·54	94
1882	29·56	92
1883	27·60	96

These data appear to show that an endemic fever had taken on the character of an epidemic during the years 1881–82. This is not an unfrequent occurrence in fever districts, and usually attracts more attention than the current amount of disease is apt to do. But the only safe manner of considering the subject is to deal with the normal fever mortality and its causes, and if this be done we shall have a generally lower death-rate and fewer fever outbreaks. A contrary course of proceeding, including, as it necessarily does, relaxation of effort when the fever has ceased to take on the epidemic form, is sure to lead to loss of life.

35. In *Dinagepore* district the fever mortality was 17·17 per 1,000 in 1883, but the death-rates varied in different thanas between 20·40 per 1,000 in Patiram, and 71·94 per 1,000 in Dinagepore thana. It is clear that the latter of these thanas is a fever locality, and must be dealt with as such. We have specially adduced it, because of its possible relation to the results of the following

drainage work in Dinagepore town, which has a population of 12,560, of whom 215 died of fever in 1883.

The town was drained on the recommendation of a special committee of inquiry. The work was begun in 1879 and completed in 1881, but we can form no opinion as to its real character, and whether it was suited to its purpose, because no account of it is given. All we have to deal with are the following figures:—

Years.	Deaths per 1,000.	
	Fevers.	All Causes.
1874-78	12·44	25·56
1879	14·10	23·00
1880	14·71	21·70
1881	12·92	19·74
1882	13·69	19·98
1883	17·11	22·29

This abstract shows a general decline in the death-rate since the drainage work was taken in hand, with an increase in 1883, which was apparently due to the generally augmented fever mortality in that year. But besides the variable amount of fever which the table shows, there is no doubt of the striking difference between the fever mortality of the thana and that of the town. It is even possible that some of the town mortality may be due to the malarial condition of the thana. Any way there appears to be no sufficient reason for losing confidence in the drainage, and we are glad to see that further improvements in this direction are contemplated.

36. Rajshahye district had the largest district fever mortality of 1883. 91 per cent. of its villages suffered, and 30·12 per 1,000 of its inhabitants died of fever "chiefly of the intermittent type, "recurring frequently, and complicated with enlargement of the spleen and liver, anæmia and "malarial cachexia." One of the thanas, Putia, had a fever death-rate of 41·09 per 1,000, and the fever appears to be increasing in fatality. The cause of increase in 1883 is considered to have been bad water, caused by deficient rainfall. The magistrate states, "that many good tanks of former "years have been neglected, so that now most of the village tanks contain decomposed water. The "radical remedy is good tanks and wells, but these the people do not supply, owing to their "ignorance of the benefits of good water, and pretended poverty, nor will the zemindars render "assistance in this matter, although the cost of a good well is only five rupees, as they are fatalists, "and look upon the occurrence of sickness as calamities that human agency cannot control." We have here, in a few words, a prominent disease cause, its remedy, and how it could be done, but there is no moving power, and this the Government might supply with public advantage.

37. Rungpore district had a fever death-rate of 15·68 per 1,000, and the town of 19·06 per 1,000 Although the mortality was not so high as that of many other places, the magistrate says, "that "nearly every morning on arrival in Kutcherry he found a little pile of letters from the amlah "asking to be excused attendance on account of fever; that many had to go to their homes more or "less invalided, but he himself, who had never been ill for 20 years, had an attack; that up-country "men suffered particularly, being unable to shake off the disease like natives of the district; that "nearly all who had been in the service of Europeans had been laid up, and that of their number "some died." These facts resemble those formerly adduced regarding Burdwan, where, at times, prisoners had to bring home the police officers in charge of them.

38. Rungpore town is one of those in which drainage works have been carried out. But we have had no account of their nature. The drainage was begun in 1873 and completed in 1882, and the following have been the statistical results:—

Years.	Death-rates per 1,000.	
	Fevers.	All causes.
1873-77	19·95	36·88
1878	20·20	34·22
1879	13·06	24·82
1880	18·15	25·54
1881	19·21	26·50
1882	18·39	23·64
1883	19·96	29·57

"The scheme, however," says the Sanitary Commissioner, "is only a partial one, and does not "drain many extensive swamps to the east of the town, which undoubtedly exercise a prejudicial "effect on its health." He is nevertheless of the opinion that, so far as drainage has been carried out, "it has done its work." The town is not large, and contains 13,320 people. And, although the statistics show a large reduction in the general death-rate and in the death-rate from fevers, the magistrate's statement proves the extensive prevalence of fevers, possibly in less fatal forms; any way it cannot be said that the public health from this cause is satisfactory where the public service is interfered with in the way he describes. It is evident that this Rungpore fever is part of the general

fever of the district, aggravated possibly by town conditions of life, and that the remedy required is the extension of drainage works and the abolition of swamps. In estimating the results to health it should be stated that the more recent statistics include deaths which have been brought into account by progressive improvements in registration.

39. In Bogra district, certain thanas which suffered most severely from fevers are situated in localities where "rank vegetation and dense jungle abound, and the drainage is defective."

40. In certain thanas in Pubna district the fever rate was from 3 to 3½ per cent., connected apparently with local deficient rainfall, while "the reduction of temperature had, by inducing severe "complications in fever cases during the cold season given rise to high mortality."

41. In certain parts of Serajgunge town "the fever was of the remittent type, and prevailed in "April with great virulence and speedy fatality; the villages attacked are situated on low undrained "swampy land surrounded by dense clumps of bamboos, preventing perflation and sunlight, and "honeycombed with filthy excavations which receive night-soil, cow-dung, kitchen refuse, and house "drainage; and uncovered municipal trenches exist in close proximity to the town." The municipality should see to these disease causes being dealt with, and also whether the closing of a trench which admitted river water to the excavations had caused increase of fever. The real remedy, however, is filling up the excavations.

42. Fevers prevail with great severity in some parts of Dacca district, and the causes are stated as follows by the Civil Surgeon and magistrate. These are "the general tendency towards silting up of "the whole river system in the district owing to changes in the course taken by the bulk of the "Brahmaputra water, which, instead of passing as it formerly did through the extreme eastern "portion of the district into the Megna, now flows to the west of it, through the Jumna, into the "Pudma Ganges." This change is attended by the usual concurrents of failing streams and stagnation of subsoil water and fever.

43. In Faridpore district, but more especially in the Faridpore municipality, fever prevailed severely. "About four-fifths of the inhabitants had one or two attacks during the last quarter, many "had two or three relapses, and in a great number of the poorer classes enlargement of the spleen "and liver, jaundice, diarrhœa, and, in some cases, dropsy supervened." The fever death-rate was 29·23 per 1,000. The Civil Surgeon assigns this severe fever outbreak to the usual local insanitary conditions, want of conservancy arrangements, defective drainage, bad water-supply, jungle around houses, "interments within the compound of houses," crowding, and similar causes.

44. The chief fever causes in Backergunge district appear to be connected with defects in surface and drainage.

45. In Mymensing district "the localities near the Garrow hills and the Medhupore forest, where "jungle and rotting vegetation abound, and the condition of the tanks is bad, again suffered severely "from fever." River changes have also added to the prevalence of fever.

46. In Tipperah the fever death-rates were lower than in other districts taken as a whole. The higher side of the district suffered least, and "the most unhealthy parts are those towards the west, "where the general level of the land slopes towards the river Megna, which, with its numerous "tributaries, keeps the soil waterlogged and the subsoil waterlevel close to the surface."

47. In Mozufferpore district increase of fever in certain areas is ascribed to atmospheric causes.

48. In Durbungha fever is attributed to the generally low level of the country, and to the yearly occurrence of inundations, leaving large marshy tracts which never dry up.

49. In Sarum district fever is attributed by the Civil Surgeon to irrigation, and the greater difficulty experienced in draining the country owing to the railway now forming a bund across it. The fever mortality in this district is, however, not high.

50. The Civil Surgeon of Maldah gives the following account of the fever causes in this district:— "Groups of people congregated thickly together in villages surrounded by soil sodden and saturated "by the excremental discharges of years, little or no ventilation, air poisoned by the miasmatic "exhalations of decaying animal and vegetable *débris*, and water rendered impure by nature and art "are all quite sufficient to account for the spread, if not for the origin, of disease in an Indian "village."

51. It will be gathered from these facts regarding local fever causes in 1883, that these causes have been the same as those which have always acted. The primary causes of increase and diminution of fever are atmospheric, and atmospheric causes are beyond human control. But of equal importance are terrestrial agencies connected with the hydrography of the country, and these can be dealt with only to a limited extent. The courses of great rivers cannot be altered, but any local drainage defects attributable to the irregular action of rivers may be more or less remediable. But the main causes of fever prevalence which may be fairly laid to atmospherical and topographical conditions are not the main causes of fever mortality. These, as has been clearly shown in the present, as in previous Bengal Reports, are purely local. They are connected with the drainage defects and marshy conditions of defined areas which surround towns and villages. These admit of more or less remedy by suitable drainage works, or by belts of trees where drainage could not be carried out. But the main causes of fever mortality are to be sought in towns and village houses, and what the nature of these death causes is has been long known, and is fully given in the cases we have abstracted from the present Report. In choosing which of all removable causes we ought to begin with, there cannot be a doubt that the sanitary condition of houses and house compounds, including water-supply, should be at once taken in hand. This implies cleansing and keeping clean all houses and compounds,

protecting water-sources or providing new and wholesome supplies, town and village drainage by simple methods for removing surface water, filling up excavations, regulating the surfaces for surface drainage, none of them very difficult processes, should be at once taken in hand, and then the drainage of surrounding marshy areas. It should be kept in view, as an axiom in sanitary work in India, that disease causes are chiefly to be found in the dwelling itself and its immediate surroundings.

52. *Bowel complaints.*—The statistics of death causes registered under this head present the usual anomalies. Returns of such deaths were made by all the registration circles, with 20 exceptions only, showing how widespread were the diseases (chiefly diarrhœa and dysentery) which gave rise to them, but, nevertheless, the whole year's mortality was reported from no more than 23,120 villages out of 248,751, facts which appear to justify the views of the Sanitary Commissioner, that bowel complaint deaths have been enormously under-registered. Taking the facts as they stand, for there appears to be no reason to suppose that errors of this kind are greater in one month than in another, we may place side by side the mortality from these diseases with that from cholera already given, in order to see whether any relation can be traced between them :—

Months.	Total Deaths.	
	Cholera.	Bowel Complaints.
January	10,675	5,138
February	4,702	4,084
March	6,277	4,056
April	11,021	4,552
May	13,187	4,221
June	14,382	3,814
July	8,235	2,524
August	6,994	5,178
September	2,613	4,787
October	2,289	4,445
November	3,725	4,868
December	8,182	5,578

This comparison shows that there was no relation between the two classes of mortality in 1883, that cholera bears marks of much more accurate registration than bowel complaints, and were the data reliable they would show that the former disease was a true epidemic and not the latter.

53. The causes assigned for bowel complaint mortality are great alternations of temperature in July, August, and September, extreme cold night air and heavy dews of January, November, and December, acting on numbers of poor people insufficiently clad and poorly fed, who live in unwholesome localities and use bad water.

Bowel complaint mortality is hence set forth as an index to a generally defective sanitary state of the people, as distinguished from the action of purely epidemic causes, which is not far from the truth. The death-rates, however, vary greatly in town and country areas, to some extent due to the better registration in towns, but still the difference is too great to be attributable solely to this cause. The town-rate in 1883 was 3·54 per 1,000, and the country rate ·73 per 1,000.

54. *Injuries.*—Under this head were registered 23,670 deaths, or ·35 per 1,000 of the population, and of these deaths 10,071 were attributed to snake-bite and wild beasts, and 2,472 were suicides.

55. *Other diseases*, out of nomenclature, occasioned 152,817 deaths, or 2·30 per 1,000, or about a seventh part of the year's mortality.

56. *Port of Calcutta.*—We shall conclude this sketch of the year's sanitary history of Bengal by the chief facts relating to the floating population, which may be summarized as follows :—

The port was visited by 21,005 European seamen in 1883. When the census was taken in 1881 the numbers actually in port were 2,791, but this exceeded the estimate made by the Health Officer in 1883, which was 1860. The total cases and deaths which took place from among the year's visitors were as follows :—

Diseases.	Cases in Hospital.	Deaths.
Cholera	65	38
Diarrhœa	164	—
Dysentery	90	4
Fever, enteric	—	—
" malarious	323	4
" simple	114	—
Scurvy	14	—
Small-pox	3	—
Sunstroke, &c.	4	5
Other diseases	1,169	40
Total	1,948	91*

* Including 10 deaths out of hospital.

The death-rate from all causes among the year's visitants was 4·33 per 1,000, of which 1·76 per 1,000 was due to cholera. If the census population be adopted as an average, the death-rate for the year would be 32·60 per 1,000, and on the Health Officer's estimate it would be 48·92 per 1,000, and of this amount 20·42 would have been due to cholera. It seems probable that both ratios do not afford a correct estimate of the year's facts, at least in so far as any comparison can be made between them and the ratios for a fixed population. Probably the more correct account of the facts is the first one, which implies that out of so many visitants so many died.

If the population element could be relied on, the rates of successive years would be comparable, and the relative health expressed in figures, but in the present case we are informed that out of 65 cholera attacks 38 were ascertained to have taken place in new arrivals of less than a month. In this case sailors arriving from the open sea, at a port where there was cholera, paid the usual penalty of such arrivals. It will be observed that in the preceding table there is no entry of enteric fever, of which happily there was no case in 1883.

57. *Native port population.*—This was found by the census of 1881 to have been 25,409, and during the year there were 8,606 arrivals. There were 178 deaths, or 7 per 1,000. Of this number 116, or 4·56 per 1,000, were due to cholera. Both rates are unreliable, for it is not at all likely that there should be so great a reduction of mortality from that of Calcutta. The true reading of the figures would apparently be that out of such a number of people so many deaths had come under registration, and then the question would naturally arise, what had become of the others.

58. *Sanitary works, civil.*—Information under this head is given in abstracts which show the expenditure on sanitary works and measures in 177 municipalities and unions in Bengal in 1883. The total income, including the previous year's balances, for all these municipalities, amounted in round numbers to 332,876*l.*, and of this amount 34·48 per cent. was expended on sanitary works against 30·75 per cent. in 1882. The increase is partly due to removal of the police charges from localities doing sanitary work. Some towns spent little for sanitary purposes, but many others spent a large portion of their resources for this object. The year's expenditure may be classified as follows:—

	£
Conservancy and latrines	30,795
„ establishment	32,586
Drainage	9,606
Water-supply	16,044
Disposal of dead	762
Markets and slaughter-houses	1,653
Vaccination	1,099
Treatment of sick	16,933
Other works, sanitary	5,308
	£114,786

To this has to be added a sum of 60,616*l.* spent on construction, maintenance, and repair of roads all bearing more or less on sanitary objects.

59. *Drainage.*—The larger class of works of drainage or water-supply are under survey, consideration, or execution. To this class belong works of drainage for Serampore, Ghatal town in Midnapore, Berhampore, Lalbagh, Azimgunge, Dinagepore, Chittagong, English bazaar in Maldah and Cuttack. These works include drainage of areas also.

In Nuddea, where severe fevers were partly traced to drainage obstructions from public works, required waterways had been constructed or were under execution, and drainage outlets of considerable extent had been carried out in other parts of the district. It is too soon to look for results to health, and we do not know precisely the relation of the works to fever areas, but it may be stated that the Nuddea fever death-rate, which had been on a five years' average 30·20 per 1,000, was 27·60 per 1,000 in 1883. An important question regarding the Bengal and North-Western Railway was under consideration of the District Engineer in consequence of a report by the magistrate that unless sufficient waterway were provided the railway would back water a densely peopled district. This, of course, will be attended to.

The great swamp to the south of Rajmahal had been surveyed with a view to drainage of this fever source. Any drainage works in the towns will be chiefly by surface drains, but care should be taken not to make them of deep section. Shallow impervious surface drains are best.

60. *Water-supply.*—Under this head it is stated that the water-supply for Burdwan town had made much progress. Three settling tanks had been completed, a masonry clear water reservoir was under construction, pipes had been laid down in the streets, and filters were being formed. When this important work has been completed, and the people have access to pure water for domestic use, it will be of great public importance to watch the statistical results to health.

Burdwan town has a population of 34,080. Its five years' average death-rate had been 29·14 per 1,000, but in 1883 the rate had risen to 45·46 per 1,000, of which 3·55 were due to cholera, and 27·84 per 1,000 to fever. This is just one of the trial examples of unfrequent occurrence, from which important experience for future direction of local works may be obtained, because the the element of impure water will have been eliminated, and the result on the death and disease statistics ascertained. It would, however, be very advisable to complete the town drainage at the

same time, so as to remove the water, otherwise it is quite possible that the mortality may be apparently raised by an improvement which ought to have lowered it. A water-supply for Hughli was under discussion, and also for Howrah, but it had been doubted whether a good supply could be had from the river below Pulta. These projects are part of a more extensive one for supplying the riparian towns which suffer severely from cholera with water, and a wholesome source is indispensable. The matter was fully examined by the Army Sanitary Commission at the time the Calcutta water-supply was under discussion, and, in our view, no lower point of intake would be safe than the one from which the present Calcutta water is taken.

The proposed extension of the Calcutta supply to the suburbs to the ultimate extent of 4,000,000 gallons per diem had been decided on, and the requisite machinery was on its way from England. The water-supply of Berhampore had been improved by the formation of a river flushing channel to bring water for washing out and supplying tanks, &c.

Darjiling water-supply had been increased by appropriating three additional springs, laying down pipes, and erecting hydrants. Defects in the filtering arrangements at Dacca had been remedied. A project for supplying Bhagulpore town with filtered water had been submitted. In the English bazaar town in Maldah the water-sources were improved, but the municipality of Cuttack had negatived a proposal for obtaining a purer water-supply, leaving the people dependent on wells.

In Hughli district a water channel had been opened through the Kana Nuddi to bring water from the Damuda to the Saruswati river, by which a long series of stagnant pools had been turned into a flowing stream. This is a another of those test cases in which important experience might be obtained by collating the statistics for a series of years.

61. Some minor improvements are mentioned in bustees, which will, no doubt, be useful.

62. In the course of the year certain chapters and sections of various Bengal Municipal Acts were applied to a considerable number of towns and villages, referring to general sanitary regulation, lodging-houses, latrines, compulsory registration of births and deaths, and compulsory vaccinations, &c.

New Acts were also passed for the sanitation of Indian merchant shipping, the regulation of Native passenger ships, for amending the Poori Lodging House Act, and for revising the law relating to municipalities in Bengal.

63. On the subject of quarantine, it is stated that during the time quarantine was enforced against arrivals from Batavia and Sumatra, "no vessel from these ports was found to have had cholera on board." This merely repeats the almost universal experience of such proceedings. A matter of far more importance to the commerce of Cacultta was under consideration, namely, the extension of the Calcutta water-supply for Native passenger boats, which at present have to use river water.

Among proposed improvements in water-supply is the very advisable one of extending the Calcutta supply to Dum Dum, where the troops appear to have a very doubtful supply at present.

64. *Burial of the dead.*—This is a subject which has long been under discussion in India, and the time appears to have come when it should be taken into consideration with the view to some general legislative proceedings. The present practice is to bury the dead in houses or house compounds, or among the village houses, or to throw them into rivers.

The principles which ought to regulate the disposal of dead are perfectly well known, and only await application as far as possible, and in the interests of the public health, in conformity with Native feeling.

65. This section of the Report is concluded by a statement as to what constitutes "epidemic" cholera, made by the Calcutta Board to that of Egypt. We have already stated our views on this subject on other papers, and there is nothing to add to these.

66. Under the head of "*Personal proceedings*," a brief account is given of the manner in which shipping inspection is carried out. The Native Sanitary Inspector has the river divided into six districts, one of which he goes over daily in alternation, visiting the passenger and cargo boats and all descriptions of Native craft. He discovers and arranges for hospital treatment of sick, inspects the foreshore and conservancy, and reports foul cargo boats for cleansing. The following was the year's work:—

12,830 boats inspected, and 542 found filthy.
390 complaints made to the police.
327 persons found sick on board.
351 times latrines inspected, and 25 found filthy.
79 water boats inspected.

This Officer's work appears to have been well done for the Native craft.

67. The Health Officer himself inspected 815 inward and 649 outward bound vessels, and complaints were dealt with. The port inspecting work had been very efficient.

68. In the course of the year 3,866 villages were inspected by officers of the vaccination staff, and the abstracts of their work in the present report constitute not the least interesting parts of its contents.

These inspections covered a considerable area of country, and they reveal the same general neglect of cleanliness in houses and villages, the use of impure water, and, what perhaps is worse than all, an incurable apathy on sanitary questions of which epidemics of fever and cholera are the natural consequences.

One of the Deputy Sanitary Commissioners, Mr. Lyons, who appears to have been very earnest in the work, addressed the people in each village hát and bazaar visited, and pointed out defects and remedies, which were also brought to the notice of the magistrates. But he concludes that "sanitary "legislation of some sort to meet the requirements of rural dwellings is called for, if the physical "welfare of the people is espoused. My observations teach me that the people, rich and poor, educated "and uneducated alike, cannot or will not actively bestir themselves in bringing about sanitary "reforms."

Nevertheless, every one admitted their importance, but they objected to do what their neighbour would not or might not do. Even the village officers declined to act without a "perwanna" to enable them to enforce reforms. The obvious consequence of this state of matters is that the Government should step in and deal with these village sanitary problems. Something has been done for the towns, and, as we have seen, some improvements are being carried out there, but, as we have often urged, the town populations are a mere fraction of the whole population of Bengal, and it is hence in the villages that the causes of epidemics have to be encountered and overcome.

69. On the whole, the present year's Report shows advance in real sanitary work, although not by any means to such an extent as could have been desired. The registration of deaths is still very defective, and also the observation and record of facts about cholera by the local observers. But the main practical conclusion from the additional year's experience is that the remediable local causes which influence the mortality from epidemics are known; that the sanitary problems in Bengal are all included in the measures required for the mitigation or prevention of two epidemic diseases, fever and cholera; that these measures are known, and that which is really wanted is greatly increased activity in sanitary work in towns, and its extension to the vast village population, which numbered 63,694,721 in 1881, whilst the whole town population fell short of 2½ millions.

23rd March 1885.

No. 5.

Memorandum of the Army Sanitary Commission on the Report of the Sanitary Commissioner for the Punjab for 1883.

1. In the opening section of the present Report, Surgeon-Major Bellew, the Sanitary Commissioner, has given a very interesting abstract of facts connected with the census of 1881, all bearing more or less on the sanitary condition of the people, and he has also included among them a detailed account of the manner in which the vital statistics of the province are at present recorded and collected. As this subject is intimately related to sanitary work, we shall state very briefly how the facts of births and deaths are obtained.

2. The village chaukidars are supplied with two registering books, one for births, the other for deaths, "in which the entries are made on the chaukidar's report by any resident of the village who "can write (usually the *bania*, or *patwari* or schoolmaster) and the lambardars of each village are "held responsible that these entries are made."

So much for the primary record, which, if strictly followed up, ought to yield a close approximation (except perhaps in the matter of diagnosis) to the numerical facts.

The chaukidars pay weekly visits to the police stations, bringing their books with them, "and "from these books and oral inquiries from the chaukidars the police registrars compile the fuller "registers which they maintain," and the police registrar signs the chaukidar's books in token of having seen it.

The duties of inspection of registers by Sanitary and Deputy Sanitary Commissioners by Sanitary Inspectors and Civil Surgeons are carried out according to rules, and methods are adopted for checking the entries.

There are, nevertheless, difficulties in the details, especially where facts have to be recalled from memory, which may introduce errors into the final results, but these are also being as far as possible guarded against, so that it must be acknowledged that very considerable advances have already been made in this province towards obtaining accurate records of these fundamental data of all sanitary work. While admitting the necessity of improvement in vital statistics, the Sanitary Commissioner, nevertheless, states that "the system of registration of births and deaths is as complete and as accurate as it can possibly be under present circumstances."

3. The system still admits of improvement, altogether apart from the question of diagnosis, but, such as it is, we must make the best of it, and, as we shall see, it affords suitable data for most sanitary purposes. But the figures alone would afford us scarcely sufficient data for our purpose, unless certain conditions brought to light in the census report quoted by Mr. Bellew be at the same time accounted with. These are stated as follow:—"Of the whole population, not less than 53·8 per "cent. depend primarily for their subsistence upon the produce of the soil, while a further 31·7 per "cent. earn a most precarious livelihood, and of these latter some two-thirds are dependent upon "the rural population. Thus failure of rain at once attacks the means of existence of some three "quarters of the population, while another tenth, dwellers in towns, suffer from the smallest rise in "the prices and are peculiarly liable to epidemic disease. Taking the population as a whole,

" the standard of living is exceedingly low. Add to this the universal ignorance of the most " elementary rules of sanitation." And then follows this statement in the census report showing the relation of these external conditions to epidemic visitations:—" The normal course of events " seems to be something of this sort. The rains fail and distress ensues. The next year the rain " fails again, and famine devastates the country, while immigrants pour in from even less favoured " tracts which surround us, and cast an additional burden upon resources already insufficient to " meet the needs of the resident population. The famine is followed by virulent epidemics of fever " and cholera; the old and young die literally like flies, while too many succumb even in the prime " of life; the death-rate amounts to an appalling figure, and births decrease in number. Favourable " seasons follow, the population, purged of its weak and sickly elements, exhibits a marvellous " recuperative faculty, and all prospers till the swing of the pendulum brings with it a return of " famine and pestilence." In proof of these periodical visitations of famine, the following data are introduced:—

Years.	Nature of Famine.	Interval in Years.
1783	Terrible.	
1802	Moderate	19=10×9
1812	Severe	10
1817	Slight	5
1824	Severe	7
1833	Terrible	9
1842	Slight	9
1851	Moderate	9
1860	Severe	9
1869	Terrible	9
1877	Moderate	8

4. We have thought it necessary to notice these statements chiefly because they attempt to trace the periodical epidemics of the Punjab to rainfall in its influence on crops. Famine, by itself, if we can judge from the Madras experience, kills off the population directly by destruction of the intestinal mucuous membrane and consequent famine diarrhœa, and fever. In so far as fever mortality is concerned, it augments this by increasing the predisposition of half-starved people to the action of ordinary atmospheric and local fever causes, but the causes must be present as an antecedent condition. There is no proof that famine causes cholera, but it may increase liability to attacks by lowered stamina and by necessitating the use of unwholesome articles of food. Epidemics of small-pox appear to be more directly influenced in their intensity by famine, but the general death-rate from all causes is, as might be expected, greatly raised during famine years, and for the months which follow. As a matter of fact, famine years do not necessarily yield the highest epidemic death-rates, except perhaps in the case of small-pox.

5. We have no vital statistics for the earlier famine years in the preceding table, but we can give the death-rates for the last years of the series, and also of the intervening years, which have stood as follows:—

Years, including two Famines.	Registered Deaths.		
	Cholera.	Fever.	Small-pox.
1869, terrible	9,258	272,946	58,195
1870	469	275,093	27,163
1871	369	213,548	25,584
1872	8,727	264,711	23,738
1873	148	219,909	25,699
1874	78	190,631	12,026
1875	6,246	279,825	13,594
1876	5,736	351,286	10,254
1877, moderate	29	219,281	12,296
1878	215	440,492	40,271

We should scarcely be justified from these data in concluding that scarcity of food was a direct cause of epidemic disease in the Punjab. Famine rather acts on the stamina of the people who are the subjects of epidemics, and these diseases being present a starved population will suffer more from first to last than a well fed and properly clothed and sheltered people. It is necessary to keep this distinction in view to avoid the error which might otherwise be introduced of mistaking a subsidiary predisposing disease cause, which can only be imperfectly dealt with for those primary predisposing causes which are all more or less within our control.

6. We shall next discuss the vital statistics of 1883.

The population element used in calculating the ratios is that of 1881, which consisted of—

Males	10,202,083
Females	8,640,181
Total	18,842,264

Of this population 17,512,378 inhabited the country districts, and 1,318,383 were returned from 49 towns.

7. The births registered during 1883 were of—

Males	393,321
Females	341,591
Total	734,912

equal to a birth-rate for the whole population of 39 per 1,000, and for every 100 females born there were 115·14 male births.

There were considerable variations in the number of births registered in different districts. The lowest registered rate of the year was that for Simla, which was 16·04 per 1,000 out of a population of 42,945, and the highest was 53·32 per 1,000, from among a population of 1,012,148 in Sialkote district.

8. The deaths registered were those of—

Males	256,348
Females	219,393
Total	475,741

equal to a death-rate of 25 per 1,000 against a previous five years' rate of 32 per 1,000.

We have already seen that for every 100 females born there were 115·14 male births, and the death statistics show that the balance between males and females was restored by the higher death-rate among males, of whom 116·84 per 1,000 died for every 100 females.

The lowest death-rate of the year was 16 per 1,000 in Peshawur division, the highest was 35 per 1,000 registered in Muzzaffargarh. The death-rate for the districts was 25 per 1,000 against a previous five years' average of 30 per 1,000, and the ratio for the towns was 30 against a previous five years' average of 47 per 1,000.

Taken as a whole, the numerical statistics show improving registration, and also better health, in 1883.

9. The following were the registered death-causes in 1883 (population 18,842,264):—

Diseases.	Deaths.	
	Total.	Ratios per 1,000.
Cholera	190	0·01
Small-pox	12,108	0·64
Fevers	306,185	16·25
Bowel complaints	14,607	0·77
Injuries	5,363	0·28
All other causes	137,298	7·29
All causes	475,741	25·24

The following were the corresponding data for hill sanitaria and cantonments:—

Population of 4 sanitaria	19,503
„ 33 cantonments	206,698

Diseases.	Deaths.	
	Sanitaria.	Cantonment.
Cholera	—	1
Small-pox	14	5
Fevers	190	1,369
Bowels complaints	53	128
Injuries	14	50
All other causes	164	1,098
Total	435	2,651
Ratios per 1,000	22	12

We shall next discuss the death-causes of the year.

10. *Cholera.*—It seems not at all unlikely that the single death-cause which was least fatal in 1883 was cholera. Were it not that the 190 deaths from this disease form part of the cholera history of the province they would scarcely require notice.

We have stated the deaths from cholera between 1869 and 1878 in a preceding table, and we may now add the deaths for the subsequent years, which were as follows:—

	Deaths from Cholera.
1879	26,135
1880	274
1881	5,207
1882	39
1883	190

Of the deaths in 1883 there took place 5 deaths, one in each of five towns out of 49 towns in the province, and the remaining 185 deaths were returned from 17 districts out of 32. But 10 of the affected districts returned no more than 1 death each. Three districts returned 2 deaths each, one 4 deaths, and another 5, but the real outbreak, so far as it was an outbreak, was confined to two districts, Delhi and Gurgaon, the former of which yielded 39 deaths and the latter 121; but none of the towns in either district suffered. Cholera deaths were returned from 32 circles of registration out of 446, and out of 34,973 villages no more than 52 were affected, and of these 5 were in Delhi district and 20 in Gurgaon. In the former district there are 743 villages, and in the latter 1,239.

The total death-rate in 1883 was just a thirty-sixth part of the preceding five years' average rate, which was 0·36 per 1,000 of the population.

11. The next abstract shows the monthly deaths.

Months.	Cholera Deaths.	Months.	Cholera Deaths.
January	—	July	31
February	—	August	41
March	—	September	5
April	7	October	—
May	53	November	2
June	51	December	—

12. We may here notice the earlier stages of this outbreak, because, probably from defective information, the idea of importation occurs in one of the reports, in which the facts are stated as follows for Delhi district:—"There was an outbreak of cholera at Majhesar, near Ballagarh, which "commenced about the 17th April, when one Nihala and his brother were seized, and about the "20th their mother and three other persons. Those cases were called 'fever' by the villagers, and "but an imperfect history of contagion could be elicited. However, on the 28th, several people "(about 80 in number) returned from a marriage at Alawalpur, in the Gurgaon district, bringing "back with them the corpse of one of their number who had died of cholera. This, apparently, lit "up the disease into an epidemic, 38 persons being attacked within a few days, out of which number "24 died. Among the subsequent proceedings taken in this case, quarantine was observed as far "as possible."

It will be observed that this case assumes the existence of cholera in Gurgaon, and its importation directly or indirectly into Delhi district from Gurgaon on or about the 27th or 28th April.

Let us next see what the Medical Officer of Gurgaon has to say on the subject. "The disease "was first reported to have occurred on the 11th of May 1883, in the village of Jodhariabas, situated "about seven miles from the town of Firozpur, at the foot of the hills towards the southern extremity "of the Firozpur tahsil."

Hence we learn from this statement that cholera first appeared in Gurgaon several weeks after it had broken out in Delhi district. Besides these facts, the cholera map shows that in April, when the Delhi outbreak took place, there were cholera deaths in other parts of the Punjab, and the dates in the Delhi report show that cholera had already shown itself in Delhi district a week before the corpse was brought home.

The history is so clearly an epidemic one that it would have been quite unnecessary to have noticed it, except for the contagion element in it; and we have noticed it simply to enforce the necessity for practical purposes of separating between facts and theories in all sanitary reports.

13. We are glad to find that in this case active measures were taken to improve the sanitary condition of the localities. The Native Assistant Surgeon, several vaccinators, and the police constables "had cleaned up the village, not omitting the wells, to a degree it had never before "experienced. Floors on which excreta had been passed were dug up, in spite of great opposition "on the part of the inhabitants; whitewash and disinfectants were freely used." The real mischief had, as usual, been done before these steps were taken, for the epidemic lasted till the 21st May. The facts have nothing to do with contagion or importation, but they point clearly to the necessity of improving the sanitary state of villages before, and not after, they are attacked by epidemics.

14. *Small-pox.*—In a preceding abstract we have given the annual deaths from small-pox from 1869 to 1878, and, to complete the series, we shall add those for the succeeding years, which were as follows:—

	Small-pox Deaths.
1879	49,489
1880	9,145
1881	6,749
1882	6,379
1883	12,103

The data show that small-pox is a true epidemic in the Punjab liable to periods of great increase in severity, and although of late years there was some hope that a reduction of mortality to about one-half of the usual rate might have been due to extended vaccination, the great increase of 1883, it is to be feared, may show a return to the usual high average rate.

15. The disease was very extensively prevalent in 1883. Deaths from it was registered in all the 32 districts, and out of 49 towns 37 suffered, and yielded an aggregate death-rate for the whole town population of 1·28 per 1,000. The country rate was 0·64 per 1,000. An additional proof of the wide-spread prevalence of the disease is afforded by the fact that 305 registration circles out of 446 returned small-pox deaths, but, as usually happens, the outbreaks were purely local, for all the deaths were reported from 2,661 villages out of a total number of 34,973. The total small-pox death-rate in 1883 was 0·64 per 1,000, while the average five years' previous rate was 1·27 per 1,000, including, of course, years of great severity of the disease.

16. Nearly the whole mortality in 1883 fell on the younger ages. Of children under one year of age 3,056 died, and of those at one year and under 12 there died 8,571, so that, with the exception of 476 deaths, the whole mortality of the year was yielded by children under 12 years of age.

17. The following abstract gives the monthly prevalence of small-pox in 1883:—

Months.	Small-pox Deaths.	Months.	Small-pox Deaths.
January	1,155	July	1,066
February	1,253	August	596
March	1,434	September	393
April	1,277	October	294
May	1,489	November	682
June	1,478	December	1,070

This table shows the usual increase of small-pox during rise of temperature.

18. *Vaccination Report.*—This report, which has been separately submitted to us, is purely departmental, and gives a very full account of the year's work, but we are not in a position to do more than discuss briefly the results so far as these concern the small-pox death-rate.

We have already seen that nearly the whole year's mortality fell to the lot of children under 12 years of age, and it follows that, in 1883 at least, the small-pox epidemic was essentially limited to these ages. What then was the relation between these young ages and the year's vaccination work? We have already seen that the registered births of the year were 734,912, and this number constitutes the main element, as is shown by the death ages, by means of which the vaccinator can hope to diminish small-pox mortality. Although, of course, attacks of small-pox prevented in 1883 may have been due to vaccine operations performed in previous years, still there ought to be a certain current relation between the numbers born in any one year and the numbers successfully vaccinated. If this be admitted, the results for 1883 would stand as follows:—

Births, 734,912.	
Successful vaccinations, under one year	421,081
" " over one and under six	150,326
" " other ages	10,432
Total	581,839

It will be seen that in round numbers four infants out of every seven born were successfully vaccinated during their first year, and that all the vaccinations, with the exception of 10,432, were effected at ages under six.

If the preceding five years' work be taken into account we shall obtain perhaps a better idea of the extent to which vaccination has been successfully carried out. This stands as follows:—

Average annual successful vaccinations	359,097
Ratio per 1,000 of population	19·06
Average annual small-pox deaths	23,389
Ratio per 1,000 of population	1·24

If there were no deaths the entire population of the Punjab would at this vaccination rate be protected in about half a century. But as the total successful operations had increased in 1883 to 31·08 per 1,000 of the population, the progress of protection was in a much higher ratio.

19. Of late years, the Punjab has been divided for vaccination into two divisions, "eastern" and "western," within which the average number of vaccinators employed in 1883 was 275, whose work

was inspected by Deputy Sanitary Commissioners, Civil Surgeons, and Native supervisors. Since the new arrangements came into operation, vaccination has been more rapidly carried on, and there was every prospect of a lower death-rate from small-pox, until the rise in 1883 to nearly double the rate of 1881 and 1882 threw doubts on the future. There are many things about small-pox which have yet to be learned, and amongst others this very matter shown in the Punjab experience, which, however, is not peculiar to India, namely, how it happens that with an improved and extended vaccination service the death-rate should suddenly duplicate itself. We have no present means of knowing, but in this as in other sanitary questions we must in the meantime be guided by experience. We must go on in improving the general sanitary condition of the population, to render the people less liable to epidemics, and the efforts of the vaccination staff must be more exclusively directed to the protection of infants, for until the births are overtaken by the vaccinations we shall have no right to complain of occasional epidemics of this disease.

20. *Fevers.*—In a preceding tabular statement we have dealt with the relation of epidemics, including those of fever, to food scarcity in the Punjab, and we shall here continue the figures down to 1883.

Years.	Deaths from Fever.
1879	472,939
1880	327,727
1881	355,279
1882	346,680
1883	306,185

Scarcity of food began in 1877, and continued for a year or two thereafter, and the figures show a very large augmentation of fever mortality in 1878 and 1879. We have referred to these facts because they have an important bearing on the question as to whether fever mortality in this province is diminishing, which would have to be answered in the affirmative on the mere figure data in the present Report. These show apparently that the fever death-rate of 1883, which was 16·25 per 1,000, was very decidedly under the previous five years' rate of 21·94 per 1,000. But these years include the famine period. Compared with the three subsequent years given above, namely, 1880-81-82, the rate for 1883 shows a reduction of above two per 1,000, which would be so far satisfactory if it really were due to the advance of sanitary improvement. This, however, is doubtful, for the Sanitary Commissioner appears to have shown that, just as the great fever-rates of 1878 and 1879 were due to the accidental intercalation of food scarcity, which increased the susceptibility of the people to the action of ordinary fever causes, so the lower death-rate of 1883 was mainly due to the reduction of rain in that year.

21. There are 32 stations in the Punjab at which rainfall is registered, and, in the present Report, the total amount of rain registered at all stations is compared with the total fever deaths of the year. This method of dealing with the data is open to the obvious objection that it makes an average out of local extremes, and so loses sight of the influence of topography and local sanitary condition on the amount of fever. The third quarter of the year is the time of heaviest rain, and the fourth quarter the time of highest fever prevalence. This appears to be a general law for the country as a whole. The highest fall in the third quarter of 1883 showed an aggregate of 440 inches, which was much below the average of most years, and, as we have already seen, the same year's fever deaths numbered 306,185. But, to show the defects in this method of dealing with the rainfall as a whole, it is only necessary to take the year 1875, during the last quarter of which the aggregate rainfall at the 32 stations was 920 inches, or more than double the amount of 1883, but, nevertheless, the year's fever mortality with this rainfall was 279,825 deaths. The conclusion, therefore, is, that the effect of rainfall on epidemics of fever is mainly local, and is related to local topography, including soils and subsoils, as well as sanitary conditions.

22. The fever death-rates in the districts varied between 5·91 per 1,000 at Simla and 29·27 per 1,000 at Muzzaffargarh. Nearly all were under the preceding five years' average, but it must be stated that in one district, Mooltan, where the usual rainfall averages 7·17 inches, an amount not likely to influence injuriously the fever-rate, the average five years' rate including the scarcity years, was 20 per 1,000, while in 1883 it was 20·85 per 1,000, the same rate, or nearly so, continuing throughout the entire period, pointing, in all probability, to other elements of climate outside rainfall as affecting the current fever mortality.

The result which we have aimed at in this discussion is to obtain, as part of the current year's sanitary history of the Punjab districts, the local rainfall in relation to the local fever death-rates.

23. In 1883 fever deaths were registered in all the 49 towns, and yielded a death-rate of 13·89 per 1,000, and the rate for the country districts was 16·43 per 1,000. Of the 446 registration circles all returned fever-deaths, with the exception of one circle in Hazara.

The monthly prevalence of fever is shown in the following abstract:—

Months.	Fever Deaths.	Months.	Fever Deaths.
January	38,242	July	20,754
February	28,218	August	21,382
March	25,822	September	20,808
April	21,454	October	24,043
May	24,241	November	27,144
June	24,541	December	29,516

Fever prevalence was very extensive. We have seen that all the districts and all the registration circles with a single exception returned deaths, and out of 34,973 villages deaths were registered in 26,624. Many of the villages are small, and it is not improbable that every village yielded fever cases, although all did not register deaths.

For a number of years past an inquiry has been in progress into the connection of fever mortality with irrigation works in 48 villages situated on the West Jumna Canal (25 in Delhi and 23 in Karnal), and the following abstracts give the facts up to the present time:—

Villages.	Population.	Total Deaths per 1,000 of Population.				
		1879.	1880.	1881.	1882.	1883.
Delhi - -	27,983	65	47	58	46	37
Karnal - -	15,153	76	44	44	37	32
Province - -	18,842,264	38.	27	30	27	25

For agricultural populations these rates are still high, but it is satisfactory to see that they are falling. During the five years in the table there were only 11 deaths from cholera in all of them, and by far the most important assigned death-cause was fever, the annual deaths from which stood as follows:—

Villages.	1879.	1880.	1881.	1882.	1883.
Delhi - - - -	1,481	1,036	1,192	346	712
Karnal - - - -	867	511	447	395	307
Total fever deaths - -	2,348	1,547	1,639	741	1,019
Ratio per 1,000 of population	54·6	36	37·7	17	23·6
Ratio of province - -	25·1	17·4	18·8	18·4	16·25

These fever-rates are excessive, although apparently undergoing reduction, but without a detailed sanitary inspection of the villages it would be impossible to assign the amount of fever due to irrigation. When compared with the ratios for the province during the same years, they throw suspicion on irrigation, to say the least of it.

24. The Report contains no new information on the local causes of these fevers, but their nature may be easily inferred from the inspection reports, which will be noticed in the sequel.

25. *Bowel complaints.*—Deaths under this head were registered in all the districts, in 421 out of 446 registration circles, and with one exception in all the 29 towns; but comparatively few of the villages suffered, only 4,209 out of 34,973. The deaths registered were 14,607, or 0·77 per 1,000, against a previous five years' average of 1·31 per 1,000. The bowel complaint mortality for the country circles was 0·68 per 1,000 of the population, and for the towns 2·06. It may be remarked that the reduction of 1,353 deaths in 1883 from the number of the preceding year co-existed with a reduction in the deaths from cholera. The mortality by months stood as follows:—

Months.	Bowel Complaint Deaths.	Months.	Bowel Complaint Deaths.
January - - -	1,162	July - - -	1,270
February - - -	858	August - - -	1,345
March - - -	813	September - -	1,437
April - - -	934	October - - -	1,498
May - - -	1,426	November - -	1,456
June - - -	1,329	December - -	969

There is nothing under this head calling for remark.

26. *Injuries.*—Deaths so classed include 257 suicides, 303 wounds, 2,444 accidents, 1,359 deaths from snake-bite and wild beasts. To snake-bite alone were due 1,189 deaths, the largest number so registered during the last five years, and within this term no fewer than 5,001 deaths have been assigned to the same cause. With an increasing annual death-rate, it would appear as if more activity in the destruction of venomous snakes were necessary.

Deaths from hydrophobia amounted to 117, and of other deaths from wild animals 16 were caused by jackals, 14 by stings of scorpions, five by wolves, four by bears, and one by a tiger.

27. Deaths registered under the head of "*all other causes*" were 137,293, and of this number 30,681 deaths were distinguished as having been due to chest diseases, which appear to be most prevalent and fatal during the winter and early spring months, when cold and rapid temperature changes prevail. We may here repeat what we have formerly said, that the Sanitary Commissioner is doing good service to the public health cause in the Punjab by rescuing these deaths from the general confusion during recent years; for in so doing, he has shown that climate has a very

important influence at present without adequate compensation in local habits on the public health of the province, and that the mortality entered under this new head is of far more importance numerically than the mortality from cholera. Apparently the next step in this direction would be to form some approximate estimate of the relative proportions in which different forms of chest affections contribute to the total mortality assigned to these diseases.

28. *Sanitary works (Civil).*—This section of the Report gives a brief abstract of the sanitary work done in the course of the year in municipal towns within the districts, and also a few notices of village work which are of importance not so much from their extent as from the fact which they indicate, namely, that some kind of a commencement has been made in dealing with the sanitary state of villages in the vicinity of stations and municipal towns.

29. The year's expenditure is given for 201 municipal towns, in the 32 districts, and the best way of showing the rate of sanitary work and progress in them will be to extract from the Report the following table, which shows under one view the expenditure incurred under the usual heads of improvement, and the annual increase of each item :—

	1880.	1881.	1882.	1883.
	Rs.	Rs.	Rs.	Rs.
Conservancy establishment	382,194	389,118	416,276	441,293
Paving	68,914	54,448	74,059	79,127
Roads and bridges	215,389	223,801	257,427	258,032
Drainage and sewerage	178,046	88,865	177,683	109,838
Water-supply and improvements	85,532	85,629	122,792	282,947
Widening streets	578	43,617	35,231	20,416
Latrines	25,062	14,160	12,094	18,285
Repairs of ditto	6,207	9,999	7,728	9,833
Total	961,872	909,637	1,103,290	1,219,771

From these data it follows that steady progress is being made in sanitary work, so far as this is indicated by expenditure.

We have not the vital statistical data corresponding in area with that included under the expenditure; but if we take the data for the 49 chief towns, with their population of 1,310,383, it would appear as if the money had been well spent, for we find that the previous five years' average death-rate, which had been 47 per 1,000, was represented in 1883 by a ratio of 30 per 1,000 from all causes, and that these towns had only five deaths from cholera among them. Their cholera death-rate in 1883 was 0·003 per 1,000, while the district rate was 0·01 per 1,000, or about thirty-three times greater. In these comparisions, however, we must bear in mind that there was no epidemic of cholera. But the facts, as a whole, appear to show that the public health is improving.

30. We shall next abstract from the Report a few details showing the kind of works executed during the year. The Public Works Department had finished a covered drinking water tank at Deoband outpost, and drinking water tanks had been completed on a road in Rawul Pindi division. The new water-supply for Amritsar city was well advanced, but little had been done with the intramural drainage scheme. The following account is given of the extramural drainage scheme of this city :—"It is hoped, by the end of the official year, the outfall channel from the city of Amritsar "to the Hudyara Nala, a distance of 12 miles, will be completed. This channel has a width of "25 feet at the head, and 45 feet at its tail, and the bed of it at the head is 13 feet below the circular "road round the city walls, and is so designed as to carry off all water which now lies around the "city of Amritsar and its vicinity."

The only remark suggested by this account, and in the absence of necessary details, is the expression of a hope that methods may have been adopted to prevent injury to health by the exposure of a large area undergoing evaporation and drying up. On the other hand, it is satisfactory to learn that the filling up of the deep surrounding ditch has been undertaken by the municipality, and that the surface gained will be laid out as a garden. Plans for draining Sialkote city have been completed and are waiting for orders. A water reservoir for Simla was under construction. A large water tank for a fair town in Rohtak district was nearly completed.

31. The municipal reports contain information of interest to the future progress of sanitary works. In Delhi road making and surface drainage made progress during the year. Drain cleaning was carried on, and some of the sewers were periodically flushed. The municipal committee had obtained sanction to send their late engineer to England to obtain skilled opinions on their proposed works of drainage and water-supply. The conservancy of Delhi was considered satisfactory, except in places where cattle are kept, and a sub-committee had been appointed to consider the subject of municipal cattle stables adopted some time ago in Bombay. Roadside trees were maintained. There are 255 carts for conservancy purposes, but with 45 public latrines in use there appears to be considerable difficulty in dealing with the night-soil after removal. At present it is pitted with lime, but after three years' trial it has been found to be not a remunerative process, and it causes nuisance. It has been determined to trench the whole of it, which ought to answer as well as afford a profit if it be properly managed. Only Rs. 731 were realized in 1883 from sale of manure. The death-rate of Delhi, which had averaged 64 per 1,000 in the previous five years, was 40 per 1,000 in 1883. There was no cholera, but above 50 per cent. of the deaths resulted from fever. In Delhi district, "no "village committees have been formed. Whatever action is necessary is taken by tahsildars working

" under the orders of the Deputy Commissioner, zaildars and lambardars being the agency usually " employed."

32. In Gurgaon a number of small towns have been undergoing improvements by the aid of municipal committees. The work has been chiefly conservancy. The Sanitary Inspectors have obtained, in a number of instances, more attention on the part of village officers to the condition of villages.

Improvements in drainage and water-supply have been carried out in several towns in Karnal. Many villages had been inspected by vaccinators, and manure heaps removed from them.

33. In *Hissar* " the conservancy arrangements of all the municipal towns are satisfactory, and each " municipality has, as far as its funds permit, sufficient establishment to keep the towns clean, surface " drains have been cleaned, and wells cleared out."

Similar improvements are reported from *Rohtak*, *Sirsa*, and *Umballa*.

34. The *Ludhiana* drainage scheme has been in abeyance from want of funds, but steps have been taken to prevent the inhabitants from converting the existing deep flood water drains in the streets into cesspools for house filth. All wells are cleansed annually, and a large number have been provided with covers to keep out leaves and other kinds of impurity. " A splendid tank " was under construction at Khana. The conservancy establishment was on an efficient footing, and all the manure collected by it is speedily sold.

All village sites " are brought under cultivation, no filth or refuse is allowed to be collected on " spare sites. Pillars have been erected 200 yards away from villages as boundaries beyond which " filth is deposited and the calls of nature obeyed." The sale of manure has realized nearly 500*l.* a year for Ludhiana.

35. *Simla.*—The water-supply works for this large hill station had been advanced, and the method of removal of house sewage, which we formerly discussed, by iron pipes downwards to a favourite waterfall and below it is now under trial. It now remains to be seen whether the objections which had been raised against this scheme have been obviated, or whether the system of trenching or sewage irrigation would be better.

Improvements in surface drainage, in water-supply, and in conservancy are reported from Jullundur, Hoshiarpur, and Kangra districts.

36. *Amritsar.*—The municipal report gives some further information about the drainage works about to be commenced. Their object " is to dig intercepting channels round the city, to catch and " carry off, at once, rain-water to a distance of 12 miles from the city. The scheme, when complete, " will be an immense boon to the city, as it will, by rapidly carrying off the rainfall, prevent the " rise of the subsoil water, which is at the present time quite close to the surface, and an undoubted " cause of sickness." In a former Memorandum we discussed at length the relation of the water-logged condition of the subsoil to the fatal Amritsar fever epidemic, and we must hope that the proposed works may serve their object in removing the subsoil water.

" Within the city walls much has been done during the year towards improving the drainage." It appears that large underground sewers had been laid down, and that the same result followed from them as formerly did in London. " One sewer, when opened, was found almost choked up with " about four feet of solid black putrid matter." These sewers must apparently have been built to remove the rain-water, which usually falls for a few days only in the year in sufficient quantity to cleanse a sewer of these dimensions. With plenty of water constantly flowing through them they might have been kept clean. But, as is proved by experience, the best way of removing the rainfall which occurs in great amount only within a short period of the year is to provide for this event over the surface.

One of the sacred tanks was cleared out in the course of the year, for the first time within living memory. The work was done by some two thousand of the people, who removed about three feet of sludge from the tank bottom and carried it up the steps to the tramway for removal. In the course of the year above 2½ millions of cubic feet of earth had been used in partially filling up the city ditch. This earth and the city sweepings were removed by a tramway, the materials for which were obtained from England. It is on the two-feet gauge, and appears to do its work quickly, effectually, and in a cleanly manner. The cost is also very much less than by carts. For the time the tramway had been in use, the gross saving over the outlay incurred for the usual methods of removal had been, for conservancy Rs. 5,849, city ditch Rs. 7,109, and making all deductions for wear and tear, &c., there had been a clear profit of Rs. 8,000, a result which shows that even in a country where labour is of the cheapest, there may be large savings by a judicious use of mechanism. In the present case the savings will have repaid all the capital expended in six years.

In a former Memorandum we showed how important the experience of fatal fever epidemics in Amritsar was to the questions involved in the fever etiology of India, and now that sanitary work has been taken up in earnest, it will be of great importance to watch carefully the results to health.

37. Improvements in surface drainage, paving, water-supply, &c., are reported from 15 municipal towns in Gurdaspur district, in 14 of which an aggregate sum of Rs. 4,425 was realized by the sale of manure. It is not much, but still it shows what can be done in this direction.

In this district improvements are reported in a few villages.

38. *Dalhousie sanitarium* in this district appears to be losing its reputation. " The water-supply " is notoriously imperfect, and urgently requires seeing to. . . . . The drainage of the bazaar " is very defective; it has gone on from bad to worse year after year." And then follows a state-

ment which shows how this deterioration has taken place, and the administrative defects to which it appears to have been due. "It is clear that the sanitarium has declined in effectiveness. The "place has become now popular, the bazaar has increased in size, and there has been a constant "change of offices, it only of late having been the rule to keep the Assistant Commissioner in charge "for two years. Houses have been erected to which no system of conservancy could be said to "apply, and the municipality have not always been so much on the alert as was advisable. The "supply of sweepers was insufficient, and they were not actively supervised. The result was that "though here and there private latrines were erected and used, as a rule all the house and stable "refuse was simply thrown down the hill side, polluting the air and the water-supply. Each hill "was more or less in need of sanitary reform, and the bazaar and the ground below the bazaar were "filthy to a degree." Steps had fortunately been taken to remedy this state of matters, which ought not to have been of possible occurrence at a place set apart for the recovery of health. But if the facts stated by the Sanitary Commissioner in any degree represent the usual course of matters at sanitaria, it need occasion no surprise that cholera, enteric fever, and hill diarrhœa attack people who, in leaving the plains, vainly imagined that they had left the predisposing causes of these diseases behind them.

39. *Lahore.*—The new city drainage works were completed, and a considerable extent of road making and repairing had been carried out. "The drainage of the main streets in the city is all "that can be desired." The city conservancy has been improving, "though much still remains to "be done." The water-supply requires to be extended.

Some attempts appear to have been made towards the sanitary improvement of villages and village sites in Lahore district, but this all-important work is still in its infancy. The town manure was sold in 1883 for 688*l.* The population of Lahore is 97,208, and that of the suburbs 41,670, and it is worthy of remark that the five years' average death-rate of the city, which had been 45 per 1,000, had fallen in 1883 to 28 per 1,000, while the suburban five years' rate of 36 per 1,000 had fallen in the same year to 19 per 1,000. It is, of course, impossible to affirm that these great reductions have been all due to sanitary work. All we know is that work has been done, and the death-rates have undergone a very remarkable reduction.

40. Besides the usual conservancy operations, no sanitary works of importance have been carried out at Sialkote, Gujranwala, Ferozepore, Rawalpindi, Jhelum, Gujrat, or Shahpur. That good work in this direction is being done may be taken for granted, as considerable sums are being realized by the sale of town manure. Improvements in surface drainage have been more or less attended to in these districts, and drainage schemes for Sialkote and Ferozepore were under consideration. But it may not be out of place to suggest that works which render necessary such proceedings as the following can scarcely take rank as sanitary works:—"In the Rawulpindi municipality openings "have been made at convenient distances" in the underground sewers to admit of their being "properly cleaned, and to these openings substantial iron sewer gratings have been affixed for the "prevention of accidents. Hitherto, owing to the absence of openings, it has not been possible to "keep the sewers clean." Apparently works of this class have been intended to carry off rain-water, and in the Punjab are only of use for a few days in the year on account of the sparse character of the rainfall. In such climates, as we have often stated, surface provision for the rain would apparently be sufficient.

41. The water-supply of *Murree*, in Rawalpindi district, "is capable of much improvement." This is an unhealthy sanitarium, subject to cholera epidemics. Some steps in the way of sanitary improvement were being taken in the villages of these districts, but not much, we fear, has been done as yet.

42. *Mooltan* appears to be under an active sanitary administration. Streets have been paved and surface drainage works carried out to remove the rain-water to a distance. Wells had been cleaned out. The municipal committee appears to have laid hold on the right method in adopting the principle of ward supervision by members appointed for the purpose, and it was hoped that before the end of 1884 the conservancy system would have been entirely remodelled and the most recent improvements introduced. The five years' death-rate for the city, which had averaged 36 per 1,000, had fallen in 1883 to 29 per 1,000.

43. In *Peshawur*, the new water-supply, which is open and carried alongside a foul water drain, was all but completed. Great improvements are reported in the conservancy, and there appears to have been good work done in surface drainage. In 1883, Peshawur had a death-rate of 34 per 1,000 against a previous five years' average of 6 per cent. Part of these lower death-rates were, however, due to absence of cholera, and in the Punjab the reduction must not be altogether credited to sanitary improvement.

44. In the other districts there is not much requiring notice. The chief measure in use appears to have been cleansing, and in some villages this work appears to have been well done. We may, however, notice the case of a fine tank at Kot Naina, in Gurdaspur, which had been useless from leakage, but had been restored to use by puddling the bottom, for the purpose of suggesting that if the water falls short and the surface is cracked by drying, the defect may be reproduced. In such cases it is better to trench the bottom and to incorporate it with silt and clay.

45. Under the head of *General Remarks and Personal Proceedings* are included official documents on sanitary matters which do not call for remark, except that they show a steady desire to forward the work of registration, vaccination, and general sanitary improvement. Difficulties in dealing with

the village problems are not over-estimated, and by way of spreading information among the people, 10,000 copies of Dr. Bellew's excellent sanitary dialogue were sent to the Punjab Government for circulation in the Native States, besides 2,570 copies distributed among the district officers.

Among the rules laid down for the guidance of village Sanitary Inspectors, they are to note the sanitary condition of villages, arrangements for storing village filth and refuse, steps taken for the protection of wells and other water sources, for keeping open ground round villages free from filth, for filling up hollows, pits, &c., for burial or disposal of dead, and generally the arrangements made for the cleansing of village streets and cattle pens. Similar duties have to be performed for municipal towns when the vaccination officers are disengaged from their special work.

The Sanitary Commissioner appears to have done a large amount of useful inspecting work in the course of the year, and his notes, as might have been expected, contain evidence of important sanitary defects, as well as of real advance in the way of improvement. He very properly insists on the necessity of vesting all the town filth in the municipality, to ensure the double object of more effective cleansing, and recovery of part of the cost by the sale of manure. But this principle must be thoroughly applied, for he shows that where part of the town refuse is so appropriated and part left to be removed by private persons, the cultivators prefer to do this rather than pay.

Another point of experience is worthy of note. It appears that the municipal committee of Delhi buried their manure in pits in the expectation that it would be improved in value. This, however, has not been the case. As part of the plan of city cleansing where hand labour and carts have to be depended on, it is absolutely necessary that there should be facilities for the daily removal and utilization of the daily town refuse, either at a distance by cultivators who might buy it, or by the municipality itself on its own ground. An area might be fertilized by digging in or ploughing in the day's manure, and this would imply access to a sufficient area to receive the refuse for a crop season. Ground area is required, whether for this purpose or for sewage irrigation, where the town may have been drained. This precaution would, of course, be unnecessary, if arrangements were made with contractors or cultivators for the daily removal of the city refuse to a distance.

We are glad to learn that in a number of instances, the local defects pointed out by the Sanitary Commissioner had been dealt with.

46. On the general question of sanitary administration, the following remarks made by Mr. Bellew appears to be worthy of consideration by the executive authorities. After stating that everywhere in the course of his inspections he was listened to with intelligent interest by the people, "but every-"where the power of initiation was wanting, and most completely so in the villages," he proceeds, "In the case of the municipal towns, I think the members of the municipal committees should "understand that they are expected to take a more active part in the discussion and examination of "sanitary works proposed for or undertaken in their towns, so as to ensure the greatest amount "of information on any particular project being considered in relation to the bearings of local "conditions and peculiarities; the neglect of this duty often leads to miscarriage of well intended "projects of sanitary improvement, and to much waste of municipal funds." He exemplifies this by cases in which the object to be attained was alone kept in view, and where the sanitary improvement effected had led to evils of another kind and to waste of money. This experience shows the necessity for sanitary supervision; but it is not peculiar to India. The object aimed at is one thing, but the way of dealing with it is quite another thing. Even in England there have been no unfrequent reclamations on the part of persons whose sanitary surroundings have been deteriorated by their neighbours' sanitary works. As regards villages, Mr. Bellew says that "much good may be promptly "and easily effected if the district Boards of Health would bring their influence to bear upon the "village headmen, in the matter of seeing to the enforcement of a proper system of village con-"servancy on the lines already sanctioned by Government, and now steadily spreading in all parts "of the province, namely, by the establishment of fixed sites enclosed within low mud walls at "convenient distances outside, and clear of the village area, for the collection and storage as manure "material of all village sweepings, filth, and litter, instead of, as is at present generally the case, "allowing the formation of dung-heaps in and about all parts of the village, and altogether neglecting "the cleanliness of their courts and passages."

47. Now that local self-government has been initiated in the Punjab, we may look for its gradual development in time, but there are some remarks on this subject in the Government proceedings which appear to represent the present position of sanitary possibilities, and which we shall quote, premising, however, that some of the difficulties are matters of opinion on the part of local officers:—

"The Lieutenant Governor holds that it is a mistake to suppose that sanitation can be advanced in "agricultural districts by the authoritative enforcement of rules most of which are greatly in advance "of the social condition and requirements of the people. . . . . When, therefore, rules regarding "sanitary improvements are placed before the people, it is necessary distinctly to explain unless "such rules are framed under the provisions of a legal enactment, that their enforcement depends "upon the people themselves, and that, in sanctioning or approving of such rules, the Government "merely assents to the promulgation of general principles, which the inhabitants of towns and "villages would do well to adopt with regard to their own interests, if they thought fit to do so." And then as to the future:—"In process of time, when the new local boards have been established "throughout the province, the question of sanitary improvement will, the Lieutenant-Governor "trusts, form one of their most important duties, and be regarded by them with special interest. "The Bill for local self-government in the Punjab now under consideration will give power to take "measures for preserving wells, &c., from pollution, and to institute measures likely to promote the "health of the people. When the people fully appreciate the benefits of sanitation, the task of

" supervising officers of Government will be comparatively easy. Meanwhile the function of the " Sanitary Department is to make suggestions for their willing adoption, and to educate them in " measures of sanitary reform."

These views of the Government are in conformity with experience. Sanitary improvement in its social aspect means a change or abandonment of long-inherited unwholesome habits of life, and in any community sanitary enactments will always be the most effective which are the expressions of known and acknowledged local necessity. Even in England we have had some experience of the opposition and inconvenience arising from compulsory enactments which are not the expression of local convictions. This is a final principle which must sooner or later be acknowledged, but if it be accepted, it in no way interferes with voluntary discussion and its resulting spread of knowledge among the people whose interests it is intended to serve. Neither does it interfere with local and personal influence in the matter of local improvements. So that it is at present in the power of local officers in India to effect a considerable amount of improvement in the more important points of sanitary work, and, by so doing, not only to lessen the amount of epidemic disease, but to pave the way for sanitary law becoming the expression of acknowledged local necessity. We have quoted Mr. Bellew's statement already, and it appears to us that what he desiderates could be to a very large extent accomplished by advice or by expression of opinion on the part of the local officer, even in the absence of legal compulsion.

48. The section on *personal* proceedings is followed by an interesting abstract of inspections made by the Deputy Sanitary Commissioners of the Eastern and Western Districts, in which the sanitary state of a considerable number of towns and villages, the works in progress, the recommendations made, and their results are stated. The information is of the usual character. It shows the presence of important defects, but also that effective sanitary work is of possible execution, and that it is making real progress. The information conveyed is of hopeful character. The Civil Surgeons in the course of their inspection tours visited 43 towns and 125 villages, but no particulars are given about their sanitary state.

49. Before concluding this Report we may state that there were no deaths among 160 children in the Lawrence Memorial Asylum at Murree, and one death from an unassigned cause among 426 children in the Lawrence Military Asylum at Sanawar. The chief admission causes were those of the febrile disease group. At the Sanawar Asylum there were several important sanitary defects especially connected with the milk-supply, water-supply, and other matters of hygiene, which appeared to require attention.

In conclusion, this Report shows clearly that sanitary improvement is making considerable progress in the Punjab. Indeed, the most important section of it is devoted to sanitary detail, and it is satisfactory to find that so much information was at hand on this, the most important of all the heads. Were it not for the very uncertain nature of one of its death causes, cholera, we might have congratulated the Government in having made a distinct advance in improving the health of the people. As the case stands, the year's experience may be accepted as hopeful, and we must repeat the hope expressed by the Lieutenant-Governor, that the new local boards may realize the importance of an efficient discharge of the sanitary duties devolving upon them to the interests of their fellow subjects, not forgetting, at the same time, that next in importance to entering on work is to take care that the work is efficiently done, and that the new authorities do not enter on a wrong groove at the beginning. An important remark under this head is made by the Civil Surgeon, Delhi district, who deprecates the spending of large sums of money on costly waterworks, which may not be quite necessary, especially where the local funds are limited, and where the object aimed at may be possibly met by improving existing sources of supply. This is a question of ordinary sanitary economics, and involves the allotment of available funds in such a manner as to secure the greatest public advantages, bearing always in mind that the works which skilled inquiry may pronounce to be the most necessary should be first taken in hand. But there are many other ways in which mistakes can be made besides in money expenditure. And these considerations point to the necessity of efficient inspection and supervision as part of the sanitary administration.

4th June 1885.

No. 6.

MEMORANDUM of the ARMY SANITARY COMMISSION on the REPORT of the SANITARY COMMISSIONER for the NORTH-WEST PROVINCES and OUDH for 1883.

1. The statistics of the North-West Provinces and Oudh for the year under review are based on the census population of 1881, which was as follows :—

Males	22,912,556
Females	21,195,313
Total	44,107,869

According to race there were—

Hindus and lower castes	38,171,728
Muhammadans	5,922,886
Native Christians	13,255
Total	44,107,869

2. Out of this population the births registered were—

Sexes.	Registered Births.	
	Numbers.	Ratio per 1,000 of Population.
Males	950,932	21·56
Females	850,469	19·28
Total	1,801,401	40·84

This abstract presents a very high birth ratio, and yet the Sanitary Commissioner informs us that "the registration is nominal, one line of the register being given to each birth, and the father or "guardian's name recorded against it, so that fictitious entries are not likely to taint the record to "any serious extent." The Sanitary Commissioner is disposed to trace this high birth-rate to early marriages and fertility; but it appears to be not unlikely that the population on which the birth ratio has been calculated has been under-estimated. How can we otherwise account for such rates, in round numbers, as 44, 46, 48, 50, and 58 per 1,000, as are credited to some of the districts? There are only five districts out of 49 which registered rates under 33½ per 1,000. The average birth-rate for 107 municipalities in these provinces was 38·38 per 1,000, which it will be observed is less than the total rate of 40·84 for the provinces. Some of the municipalities return about a five per cent. birth-rate. The most likely explanation is that the population estimates are under the truth.

3. The following were the deaths registered in 1883:—

Males	652,901
Females	563,396
Total	1,216,297

equal to 27·57 per 1,000 of population. If we assume the nominal registration as approximately correct, the deaths, when compared with the births, would show an absolute addition to the population of 585,104, or 13·27 per 1,000. No doubt the district registration shows a large amount of good work done; but we can scarcely accept this increase as absolute. The probability is that if we accept the actual registered births as approximately correct, we should scarcely be justified in accepting the registered deaths as representing the total mortality of the year.

4. The results would therefore stand as follows. The total registered births are approximately correct. The registered deaths are fewer than the actual mortality. The ratios of births and deaths to population are not reliable, probably on account of under-estimate of this last. Nevertheless, the results are remarkable, because in these provinces, with a population of above 44 millions, that which has been considered as the most difficult part of the registration, viz., a record of births, has been approximately accomplished.

It may be useful to state how this has been arrived at, in the words of the Sanitary Commissioner, who considers that the continuance of this satisfactory result "is due chiefly to the introduction of "small hand registers, first supplied to the town and village watchmen in 1881. I have," he says, "examined many of these small books during the past year, and have found them better kept, as a "rule, than I had hoped for. They serve to record the happening of a birth or death at the time of "the occurrence, and the record always remains with the village watchman, so that it is now "comparatively easy to obtain a statement of the births or deaths which have happened in any "village for comparison with the population of the village. . . . The watchman, in place of a "verbal report as before, presents his local record to the circle mortuary clerk for extract of its "entries into the register." The watchman, in fact, performs, in a way, the duties of a district or sub-district registrar without his certificates, and hence the disease nomenclature has, properly speaking, to be entrusted to non-medical agents. It is, however, no small advantage to have got so far on the road to accuracy, while on this basis of record it may be found to be possible to rear a superstructure of more useful diagnosis of local diseases. We shall presently give a curious illustration of what takes place under the present arrangement of diseases, and of the errors to which it leads.

5. We shall analyse the facts a little more in detail to show the proportion of deaths to population of the same ages.
This is shown in the next abstract.

Ages.	Death Ratios per 1,000 of Population at these Ages.
Under 1 year	322·6
1 and under 5	55·0
5 „ „ 10	14·1
10 „ „ 15	7·3
15 „ „ 20	10·8
20 „ 30	11·3
30 „ 40	12·5
40 „ „ 50	17·3
50 „ „ 60	29·3
60 and upwards	45·1
All ages	27·5

This table gives the death-rates for known ages on the census population of 1881, and it will be seen that nearly a third of the children living died before the expiry of the first year. This fact, however, overstates the ratio, because of 1,301,401 births in 1883, 384,964 infants, or 213 per 1,000 of the births, had perished within the year, so that the second year began with 1,416,437 live children to enter on the life struggle. But this reduced number had to undergo further reduction before its fifth year of age was reached, for between the ages of 1 and 5 years 244,892 of children born had disappeared. The two numbers together amounted to a loss under 5 years of age of 629,856 lives, or nearly 350 per 1,000 of the births, and there remained for future use, 1,171,545 children at 5 years of age. This great loss of life in the earlier years of existence has always been a subject of interest in vital statistics from its co-existence with high birth-rates, and has led to the view that the latter are of the nature of a law, and prevent the excessive reductions from excess of deaths; or, as the Sanitary Commissioner puts it, "indeed so potent and numerous are these (death) causes, "that nothing but a very high ratio of births could suffice to provide against the exceedingly high "death penalty." It has been generally considered, besides, that high birth-rates and high infantile death-rates point to a weak surviving population, not well fitted to withstand the influence of disease causes in after life.

6. Cantonment registration is undergoing improvement. Nine of them, including a population of 112,809, returned an average death-rate of 32·39 per 1,000.

7. One of the most satisfactory announcements in regard to the registration in these provinces is that the weekly mortality tables for 18 municipalities, having an aggregate population of 1,736,311, were published in the provincial Gazette in 1883, often in the Gazette of the week following their completion. We advised this step to be taken as far back as 1864, and nothing will more conduce to a correct knowledge and appreciation of local diseases and their removable causes than a careful detail of the facts under Government authority, with such notes as the Sanitary Commissioner may think advantageous for the purpose of directing public attention to these causes.

8. We shall next give a brief account of the disease history of the year.
The following deaths were registered under the usual headings in 1883 :—

Diseases.	Registered Deaths.	Deaths per 1,000 of Population.
Cholera	18,160	0·41
Small-pox	138,641	3·14
Fevers	830,258	18·82
Bowel complaints	66,530	1·51
Injuries	20,978	0·48
All other causes	141,735	3·21
Total	1,216,297	27·57

As usually happens, the fever mortality formed in 1883 the principal element in the year's death-rate. Small-pox, notwithstanding the vaccination work of the year, had assumed the character of a great epidemic, while the assigned death cause of least importance during the year was cholera.

9. The relation of the cholera of 1883 in the conjoined provinces to the epidemics of seven entire years was as follows:—

Years.	Deaths from Cholera per 1,000 of Population.
1877	0·74
1878	0·52
1879	0·84
1880	1·07
1881	0·58
1882	2·02
1883	0·41

The year 1882 was one of great epidemic prevalence in various regions of India, and the crowded Allahabad fair was held early in the year. Cholera had appeared at several points of these provinces before cases of it occurred at the fair. It was moving from the north-western circles of Bengal, and in the course of the year part of the epidemic invaded the Central Provinces by passing southwards along two lines of advance, and another part crossed the Ganges and caused great havoc in Rohilcund, while the Doab comparatively escaped. The fair at Allahabad began to break up when cholera appeared there, but the disease attacked pilgrims along their return routes, although there was no evidence at the time that they had spread cholera among the people. But, whether they did so or not, the facts showed that the epidemic had preceded the pilgrims, although it is possible that the overcrowding and filth attending the dispersion of some three millions of people may have added to the severity of the disease during the onward movement of the epidemic, the pilgrims in this case becoming an added local disease cause. But there is nothing to show that on any of the routes they carried cholera in their own persons and so spread it. The disease had nearly died out by the end of 1882. There were 53 deaths in January 1883, 26 of which were returned from Sultanpore district in Bareilly, and 14 from Hamirpur in Allahabad. The remaining 13 cases were scattered over the provinces at great distances from each other. The epidemic was present in January, but in low intensity. In the course of 1883 deaths from it were registered in 46 out of 49 districts, showing its general prevalence. Out of 1,147 circles of registration, 516 returned deaths, but in these 1,147 circles all the deaths were returned from 2,536 villages out of a total of 105,421. The death-rate from cholera varied greatly in different parts of the provinces. Generally, the rate was much under 1 per 1,000 of the population, and in only 7 out of 49 districts did it reach and exceed 1 per 1,000. Banda in Allahabad division had, nevertheless, the very high rate of 5½ per 1,000, the greatest in the provinces.

10. The monthly prevalence of the disease was as follows:—

Months.	Deaths from Cholera.	Months.	Deaths from Cholera.
January	58	July	4,551
February	40	August	3,248
March	184	September	1,794
April	930	October	892
May	2,084	November	140
June	4,228	December	16

We have in this table a numerical statement of a completed epidemic, apparently having its roots in the end of 1882, but only starting into activity when the month of April arrived, which is the usual epidemic course, culminating in June and July, and then declining, to die out in December.

11. The experience of this epidemic afforded several illustrations of the influence of epidemic intensity on the local death-rates. We have already stated that in very few of the districts did the death-rate from cholera reach 1 per 1,000. In Dhera Dun, which contains 366 villages, one village only suffered, and this to the extent of no more than one death. In Etawah, out of 1,478 villages, two yielded four deaths. The cholera death-rate in Etah was ·04 per 1,000, and was made up by 35 deaths in 4 villages out of 1,489 in this district. The cholera death-rate in Benares district was 1·38 per 1,000, and was the result of 1,283 deaths registered in 165 villages out of 1,946. In Banda district, which yielded the highest cholera-rate of the year, viz., 5·50 per 1,000, there are 1,166 villages, of which 305 were attacked, and 3,845 people died of cholera. These facts are only part of the usual epidemic history, and as sanitary and personal conditions remain much the same, they appear to show that local epidemic intensity exercises no unimportant influence on the mortality. The bearing of the facts on prevalent disease theories is obvious, and ought to lead to broader views being taken on the subject of epidemic diseases, for it is quite certain that none of the theories can be made to include the whole history, and that the effect of sanitary improvements which are not matters of theory, but of actual experience, are to a certain extent controlled by epidemic force.

12. Sanitary improvements have been proceeding slowly all over these provinces, and one consolatory fact is that the year 1883 yielded the lowest cholera death-rate which has been registered in the united provinces.

13. *Small-pox.*—In a preceding table we have given the annual death-rates from cholera since the union of the provinces, and the next abstract gives the corresponding death-rates per 1,000 of the population for the same years.

Years.	Small-pox death-rate per 1,000.
1877	0·8
1878	3·9
1879	1·7
1880	0·1
1881	0·3
1882	0·6
1883	3·1

These ratios show that small-pox is as much an epidemic disease in the North-West Provinces and Oudh as is cholera, and, moreover, that it is a far more fatal disease. This is shown distinctly by comparing the aggregate death-rates of the two diseases for the same seven years, as follows:—

	Aggregate death-ratios, 1877 to 1883.
Cholera	6·78
Small-pox	10·50

In round numbers, for every two deaths from cholera during these years there have been three deaths from small-pox, and this notwithstanding an active vaccination system extending over the country.

14. As already stated, there were 138,641 deaths from small-pox registered in 1883. The disease prevailed in all the divisions of both provinces, and of 1,147 circles of registration 932 returned small-pox deaths. The village returns are not complete, but, as they stand, 27,596 villages out of 105,421 suffered. Of 100 towns, all registered small-pox deaths except five. Out of the total mortality, 8,061 deaths, or nearly 3 per 1,000, were returned by the town populations.

15. The epidemic of 1883 was by no means equally distributed over the districts. In two of them, Ghazipur and Gharwal, the rate was 0·02 per 1,000, from which point it gradually rose until it reached the very high rates of 13·80 per 1,000 in Lucknow, 14·15 in Hardoi, and 17·53 per 1,000 in Bara Banki. Out of 49 districts, 10, including these, yielded the highest rates of the year, and are described by the Sanitary Commissioner as follows:—"These districts form a continuous "country of Oudh and Rohilcund north of the Ganges. And I think there is no doubt that, as a "matter of recent history, Oudh is the country of this province in which small-pox has greatest "power, and at the same time it is the portion of the province in which vaccination has made least "progress." A fact partly due to the opposition of the people to vaccination, which was culpably concealed by falsifying the returns of operations. On the other hand, there are three districts, Dehra Dun, Kumaon, and Gharwal, which had only 61 deaths from small-pox among them, an immunity comparatively which has existed for 14 years, and has, the Sanitary Commissioner thinks, been undoubtedly due "to a perfect vaccination of the people." The practical conclusion, of course, is that means should be adopted for increasing the efficiency of vaccination in Oudh, which was the chief seat of small-pox in 1883.

17. *Vaccination.*—The Report under review contains the usual departmental details regarding the vaccination service and its results. The staff for the year stood as follows:—

Superintendents of circles	3
Deputy superintendents	7
Native „	50
Vaccinators, first class	287
„ second „	352
Chaprasis and other servants	55
Total staff	754

The successful vaccinations and re-vaccinations performed by this staff amounted to 570,940, and the average cost of each successful case was 3A. 5P. Of the total successful operations of the year 565,351 were primary operations, at the following ages:—

Under one year	264,496
Over one year and under six	257,126
Other ages	43,729
Total	565,351

This shows a large proportion of the total vaccinations at the younger ages, but when the amount of work done during the first year of infantile life is contrasted with the registered births, which, as we have seen, amounted to 1,801,401, it is not difficult to see where the defects of the vaccination are to be found, and where a remedy has to be applied so far as it might by itself lessen liability to small-pox, and this lies in directing the work of the service as much as possible to the protection of infants under the first year of life, when small-pox is most fatal, and when the protection, once secured, passes onward to after life.

While calling attention to this matter we cannot, however, overlook the epidemic character of small-pox in these provinces, which has to be dealt with in the same way as must be followed with all epidemics, by the more complete removal of local disease causes, and by the general improvement in the life conditions of the population as a whole, and more especially in the care and management of infants.

17. *Fevers.*—Deaths classed under this head amounted to 830,258, yielding a death-rate of 18·82 per 1,000. Fever diagnosis is open to the usual objections that other fatal diseases attended by heat of skin are classed by the enumerators with fatal cases of true fevers. It is not likely, however, that the amount of error has differed within the last few years, and, if this be conceded, we must arrive at the not unsatisfactory conclusion that the registered death-rate, which under this head had been 26·22 per 1,000 during the five years preceding 1883, had fallen in that year to 18·82 per 1,000, showing a reduction of 7·40 per 1,000, and one of the sanitary problems of the year is to ascertain the cause of this great diminution of fever mortality.

18. Diseases which prevail epidemically have a tendency to irregular increase and diminution, and every observed fact which is likely to influence this course becomes of importance, not only as an addition to our knowledge, but for practical purposes also. We may here recall the fact that the amount of paroxysmal fever in a malarial country is influenced by temperature, moisture, and decomposition of organic matter in the soil. We may for the present purpose leave out the purely local causes, and also those connected with irrigation and defective drainage, which may be assumed as more or less constant elements in the question, the action of all of which was continued through the year 1883, as is shown by the fever death-rate of that year, and ask this question,—Which of all the known agents of increase of malarial fever had so varied in 1883 as to warrant a presumption that to this variation was due the reduction of the fever death-rate? On former occasions we have advised the preparation for the North-West Provinces Report of meteorological tables to enable the data to be compared month by month with the mortality statistics. This has not yet been done, and the information at our disposal in the present Report is only of a very general nature, but, such as it is, it may be taken as furnishing a clue to the reduced fever mortality of the year.

19. Notwithstanding the reduced death-rate, fever deaths were returned from all the districts, from 1,115 out of 1,141 circles of registration, and from nearly all the villages, 105,421 in number, and all the towns suffered. The district fever death-rate was 18·65 per 1,000, and the town rate was 21·40 per 1,000. There was universal prevalence of fever with less loss of life.

20. The following was the monthly mortality assigned to this death cause in 1883:—

Months.	Fever Deaths.	Months.	Fever Deaths.
January	74,286	July	62,716
February	63,390	August	65,810
March	67,637	September	63,744
April	71,333	October	67,648
May	72,472	November	73,950
June	70,526	December	77,146

The first peculiarity of this table is that it does not show so large an increase of fever deaths during the drying up months as is usually the case. The colder months yielded more fever deaths, and the relation of fever to rainfall is not so marked as usual. But, on turning to the section on meteorology, we find the following account of the monthly rainfall, which may be read alongside this monthly fever table:—

January.—Rainfall "about four times the average of former years."

February.—Rainfall "exceedingly light, and confined to the last week."

March.—Rainfall "exactly equal to average."

April.—Dust storms, and rainfall "decidedly less than the average."

May.—Rainfall, "the mean in May is 0·82 inch; in the 11 divisions in May 1883 it was 0·87, a "slight increase."

June.—"The rain was less than the mean in eight divisions by an average of 1·2 inches."

July.—"Rainfall in excess from 0·38 to 3·12 inches in four divisions; deficient in the others."

August.—"Rainfall was deficient everywhere in pretty equal proportions. The mean is 10·14 "inches. The average deficiency in 1883 was 6·45 inches over all the 11 divisions."

September.—"Rainfall in excess by 0·39 inch in Meerut, but deficient in all the other divisions, "and in Benares to about one half."
October.—"Defect in every division."
November.—Slight rain in three divisions, all the others rainless.
December.—The same distribution of rain.

The rainfall of 1883 appears to have been more equally distributed, and local rainfloods were absent. Irrigation was carried on as usual, but absence of undue rainfall with it led to this result, that while the fever mortality of the province was considerably less than usual, the irrigated districts returned lower fever death-rates than the average.

21. In former memoranda we have called attention to a fact, apparently established by sufficient experience in these provinces as elsewhere, that abnormal rainfall in districts under irrigation raises the fever death-rate, and in the present year's Report we have the converse of this experience, for as the following table for the 12 irrigated districts shows, deficient rainfall is attended by marked reduction in fever deaths. The table includes years of heavy rain with water-logging of the irrigated area. There was little rain in 1883, comparatively.

Years.	Fever Deaths per 1,000.	
	12 Irrigated Districts.	Corresponding Provincial Rates.
1878	29·1	22·9
1879	67·9	37·6
1880	28·0	23·1
1881	26·5	24·9
1882	26·3	24·9
1883	22·5	18·8
Aggregate	200·3	152·4

The irrigated district means include enormous death-rates. Two of them, Bulandshahr and Aligarh, during the year 1879, when the average rate for the whole 12 was 67·9 per 1,000 yielded perhaps the highest death-rates on record, the former, namely, 113·7, and the latter, 113·5 per 1,000 from fever alone. It is, however, satisfactory to have to record that these rates, in 1883, were represented by 19·1 and 17·0 per 1,000, about the average of the provincial rate of the year, which was 18·8 per 1,000.

So much for the scientific facts, so far as they are reliable, and these bear out our former contention that while in an undrained country abnormal rainfall increases the fever death-rate and defect of rainfall reduces it, precisely the same law holds good in irrigated districts, with this important difference, however, that as irrigated districts suffer from what may be called a higher fever tension than exists in non-irrigated districts in the same country, increase of rain which in these provinces generally would raise the fever-rate might at any time occasion an explosion of fever in the irrigated districts. For this result the only available remedy is drainage to keep the subsoil water moving at a lower level, more careful apportionment of water to the requirements of cultivation, and persistent attempts to improve the sanitary condition of villages and their vicinity, including the dwellings of the people. The preceding table shows that the aggregate fever death-rates for seven years for the 12 irrigated districts amounted to 200·3 per 1,000, and for the provinces as a whole to 152·4 per 1,000. The excess of fever deaths in seven years, due apparently to irrigation without drainage, and also to careless use of water, was thus 47·9 per 1,000, or about 6·8 per 1,000 per annum. If irrigation were so improved as to eliminate this excess of fever deaths in the 12 districts, the fever problem, as it presents itself in non-irrigated districts, would still have to be dealt with by drainage and improved agriculture and local remedies.

This is the result of experience, as regards fevers in these provinces, up to the present time.

22. *Bowel complaints.*—There has always been some uncertainty about deaths registered under this heading, on account of apparent anomalies in their distribution. In 1883 deaths from bowel complaints were returned from all the districts, and from 1,072 circles of registration out of a total of 1,147. The present Report does not give the deaths by villages, of which there are 105,421 in the circles; but as the whole registered deaths from this presumed cause amounted to 66,530, it is evident that many villages must have escaped deaths from bowel complaints altogether. There appears to be little doubt that the usual fatal diseases classed under this head are diarrhœa and dysentery, and these diseases are believed to be of such common occurrence that doubts have been expressed as to whether the registered deaths included anything like the real mortality. On the other hand, in the Report under review, it is stated that there are other internal diseases besides bowel diseases included under the heading. In consequence of the large mortality from bowel diseases in certain districts an inquiry was instituted, which resulted in the discovery that to an indefinite disease called *kaff* much of the bowel complaint mortality was due. This designation appears to include "inside" diseases generally, and in the present case it meant pleuro-pneumonia, because this affection is situated "inside" the chest.

It would appear as if an attempt might be made to separate chest diseases under a suitable heading with some advantage to the disease nomenclature, as has been done in the Punjab. As the registration stands the monthly bowel complaint deaths were as follows :—

Months.	Bowel Complaint Deaths.	Months.	Bowel Complaint Deaths.
January	5,502	July	5,992
February	4,323	August	7,306
March	4,428	September	6,493
April	4,793	October	5,619
May	5,669	November	5,395
June	5,859	December	5,151

The death-rate for the country district population was 1·37 per 1,000, and for that of the towns 3·55 per 1,000, the general rate for the provinces having been 1·51 per 1,000. These ratios afford the only sanitary data on the subject, and they appear to show that bowel complaint mortality is connected in the towns with local insanitary conditions.

23. *Injuries.*—The total deaths from accidents and injuries were 20,973, or 0·43 per 1,000 of the population. Among these deaths were included 571 suicides of males and 1,625 of females, 12,182 deaths by wounds and accidents, and 6,595 by snake-bite and wild beasts. This last record is the largest of seven years.

24. Under the head of *all other causes* there were registered 141,735 deaths, or 3·21 per 1,000 of the population in regard to which nothing except the numbers registered is known.

25. The year's disease history in the present Report is concluded by an instructive table, in which are placed in parallel columns the death-rates per 1,000 from small-pox, fever, and bowel complaints for every one of 318 circles of registration. If the nomenclature were correct, this table would be a valuable addition to the annual disease history of these provinces, for it would enable the epidemic localities to be determined with approximate certainty. Its chief interest centres in the column of fever mortality, and this record continued year by year could not fail to yield information of high practical importance to the application of local sanitary improvements. Where means are limited, it is an axiom in sanitary work to direct the expenditure according to the proved need in each case. This table as it stands contains sufficient data on which to proceed. But a series of annual tables would enable us to see how sanitary work was taking effect, whether it was being done, and where there were defects in the procedure.

26. Under Section IX. (*Sanitary Works, Civil*) are given brief notes of expenditure incurred and sanitary measures carried out in 80 municipal districts. These measures are mainly improvements in paving, surface draining, conservancy, and in water supply. No large works appear to have been carried out. These cases are merely selected as examples, but the Sanitary Commissioner states that "during the year 1883, works of sanitary improvement were effected in almost every important "centre of population in the province. Wherever the means of improvement are available there "some proportion of the available income is expended for the improvement of the habited site or its "precincts. These improvements of every kind and character have been reported to me for "information." A comparison of the death-rates for five years preceding 1883 would apparently lead us to the conclusion that life was being saved under the existing sanitary administration and progress. Thus, the town death-rate in 1883 from all causes was 35·32 per 1,000, while the previous five years' ratio was 40·88 per 1,000, showing a reduction of 4½ per 1,000. But it is necessary to bear in mind that in 1883 no less than 21·40 per 1,000 was due to fevers. But after all is said about work done, the fever death-rate in these towns, many of them of very limited population, exceeds what ought to be the death-rate from all causes in improved localities.

All that the facts warrant us in accepting is, that sanitary improvements have been more or less initiated, but the work as such has yet to be done, and that it really lies not so much among the town populations as among the 41,351,376 people who occupy 105,421 villages, in regard to which we have no account of work done in the present Report. These bare numerical facts contain in themselves a statement of the difficulties with which the Government of these provinces has to cope in dealing with the epidemic death-rates. We have no desire to under-rate them, but they are no more than those which have everywhere to be encountered in attempts to improve the health and stamina of the working population.

27. In connection with this subject we may allude to the inspection reports of Superintendents of Vaccination. These are—with one exception, the report of Dr. Grant—confined to their special object, and do not call for remark from us. The inspecting work of the year has been, in fact, mainly directed to the future prevention of the disgraceful falsification of vaccination returns, which we must hope will not recur. In the course of his work Dr. Grant visited localities where fever had existed, and a brief abstract of his remarks will be sufficient to show the relation of malarial fevers to local causes. He says, in regard to the town of Chibrámau, that its population of 7,990 people had lost 570 from fever, which attained its highest mortality in October, during which month 135 died, notwithstanding an apparent deficiency of rain over the country. But, on consulting the local registers, it was found that the local rainfall from June to September had been 25·6 inches. The rainfall was also irregular. There was none between the 3rd and 20th August, but on that and the

succeeding day six inches fell, a considerable part of the town was flooded, and continued to be so for many days. The town is surrounded by excavations in which all kinds of refuse are thrown, and into these holes the rain drainage flows, and remains till it dries up. There was once a small cutting for carrying off part of the rain, but this had been silted up. A somewhat similar example was met with in the village of Barwala, with 3,062 people, who were found to be sickly and still suffering from fever. The village is about a mile from the Jumna Canal, but the people of another village nearer the canal were healthy. The Barwala village was surrounded by large excavations containing filthy water. No doubt in both cases the element of defective conservancy, and possibly of impure water, also acted injuriously, but each case presents a special problem in sanitary engineering, and it is very likely that they are merely type illustrations of the insanitary conditions which render Indian villages hotbeds of epidemics.

Some of Dr. Grant's remarks about the towns are of importance.

In the case of *Saharanpur* there is a municipal committee which keeps up a local and house inspection "in a most systematic manner," but this town of 59,194 inhabitants cannot be said to be drained. In the principal streets are rain-water drains, but none elsewhere. "The house drainage "flows directly outside into the street, and, where proper drains do not exist, a great nuisance is the "result, which must be prejudicial to health. . . . In some of the places visited the stench was "quite unbearable."

The death-rate in Saharanpur in 1883 was 39 per 1,000, and there were in it 136 deaths from cholera, and 1,258 from fever. Without desiring to give advice as to the kind of drainage to be provided, we may nevertheless state that, if surface drainage is to be adopted, all the drains should be impervious and of shallow section, and that a sufficiency of water should be provided to flush their impurities to an outlet. This is what Dr. Grant proposes.

The sanitary state of *Muzzaffarnagar* was considered satisfactory.

Meerut is far in advance of other towns in the circle in cleansing and in conservancy arrangements. The population of Meerut is 60,948. Its death-rate in 1883 was 23·48 per 1,000; it had only one death from cholera, but it lost 1,200 from fever.

Bulandshahr had a death-rate of 26·48 per 1,000 out of a population of 17,863. It had no death from cholera, but 334 from fever. This town was formerly a collection of kutcha huts. It has been "transformed . . . into one of the finest Native towns of its size in India. Handsome streets of "houses, constructed in the best style of Indian architecture, have been erected, and it has all been "done by the people themselves without any assistance from Government." This experience shows what can be done in the way of improvement in the hands of an enlightened magistrate like Mr. Growse. Some defective sanitary details are mentioned, which show that in all such improvements the public health aspect of them requires to be provided for while the architectural features are improved.

The habitations in another town, *Khurja*, were found in good condition, and similar architectural improvements had been introduced, but in this case also important sanitary details had been overlooked, but they were eventually attended to on Dr. Grant's recommendation.

The city of *Koil* "was fairly clean and the drainage good," but in every other essential of good sanitary condition there was deficiency, especially in arrangements for conservancy. The reporter adds, "the public latrines are the worst I have seen in any town," and as a consequence filth was everywhere visible.

In *Ferukhabad* and other towns in Mainpuri district, the drainage works appear to be of an injurious kind. There are "deep rectangular pucka side drains, for the most part arched over, but "leaving openings at intervals . . . extremely objectionable," as Dr. Grant remarks. It is scarcely too strong an expression to designate all drains of this type as added disease causes. They ought to be taken up and replaced by impervious shallow-sectioned surface-drains, such as are described and figured in our "Suggestions" (1882). Water would have to be provided for keeping them clean. We are glad to see that the magistrate was of the same opinion, and that the necessary improvements would be carried out when funds were available.

Mainpuri is commended for its handsome bathing tank, which is well kept and supplied with water.

About *Agra*, the principal remark made refers to its deficiency of good water. "The town of "Muttra was clean, and the drainage perfect." This is the record, but there must be something radically wrong about this place. Its population is 44,745, and its death-rate in 1883 was no less than 51·82 per 1,000, of which great rate 4·74 per 1,000 was due to cholera, and 21·80 per 1,000 to fevers. These losses were not those of a specially unhealthy year, because its previous five years' average death-rate had been no less than 64·85 per 1,000. Both rates are so high as to lead to doubts about the registration accuracy.

28. Under Section X., "General Remarks," Mr. Plank gives a brief account of inspecting work of inquiry and verification of vaccination returns, and regarding a proposed change of site for Hurdwar fair in lieu of the present unfavourable one, which, fortunately, has been partly washed away by floods. An account is also given of a proposed new site for a civil station at Kulpahar for Hamirpur. There are no points in the Report calling for remark, except the amount of chloride of sodium, 7·2 grains per gallon, in the water of the proposed civil station, supposed to compare favourably with the well waters of Agra and Allahabad, which contain from 33 to 40 grains per gallon. Comparisons of this kind are, however, inadmissible, on the obvious ground that if 7·2 grains of chloride of sodium per gallon indicates bad water, it cannot become less so by comparison with worse water. The rule to be observed in all such inquiries has been known in India for many years, and is given in the late Dr. Angus Smith's words in our "Suggestions" (1882). In any given water under

inquiry, the first step to be ascertained is the amount of chloride of sodium present (not in the well waters, all of which for the purpose must be set aside, but) in the natural pure waters of the district. That is, if the source under inquiry is a well, the amount of chloride of sodium in the water has to be compared with the corresponding amount in water obtained from a pure source in the vicinity (not of course a river). The two quantities having been thus obtained, the rule for ascertaining the sanitary condition of the proposed source of supply is as follows:—"Any amount of common salt "above the average of the district obtained in a well in a city or camp, or near habitations of men "or animals, is an almost certain proof of impure drainage."

It is not probable that the Agra and Allahabad well waters represent the condition of the district waters. What the analysis really shows is that both are unfit for use, and just in the proportion that chloride of sodium in the water of the Kulpahar site exceeds the amount of the district is that water open to suspicion.

29. The present Report would have to be pronounced deficient in sanitary information about disease causes were it not that these have been discussed in the Sanitary Commissioner's Reports year after year. The causes are known for all practical purposes. The fundamental of them are those connected with local topography, such as flatness of surface, without sufficient natural fall for drainage, the passage of great rivers and watercourses through it, and the presence of large areas of tarai country. If this was all the information at our disposal, the practical conclusion must be that an adequate execution of drainage operations to relieve the subsoil of superfluous water, together with improvements in agriculture and tree planting, were the required remedies against its decimating epidemics. But we know, besides, that large tracts of country have been rendered more than usually liable to fatal outbursts of fevers by irrigation works, without adequate provision of drainage. We know, further, that in this state of the country excess of rain acts with fatal effect wherever it falls, but more especially in districts under irrigation, and that for this the only remedy is facilitating subsoil water movement to an outlet. There is a probability also that the evils are augmented by careless use of irrigation water by the people.

It is, however, doubtful if all the high-fever rate should be attributed solely to causes of topographical and climatic origin, for it is very probable that the types and the mortality of these fevers are to a great extent determined by the local sanitary defects in towns, but especially in villages and village houses.

The practical result is that causes and effects re-act, and the stamina of the working population is reduced until they succumb in turn to the effect of their surroundings.

It is at this point that these sanitary questions become intimately connected, in epidemic countries especially, with social and economic questions, and with the functions of Government.

We have said enough in this and in preceding Memoranda to point out the remedies, which are no doubt beset with great difficulties, but the difficulties are no more than those which exist in all newly settled countries similarly situated. Some of the most unpromising examples of this class have been slowly but certainly improved by the continuous operation of human agency, a condition under which large areas of the earth's surface have been and can be alone made occupiable by human beings. In these provinces, as in the rest of India, improvements of this class are of another character altogether than those required for towns, and the whole work required for diminishing the liability of the people to epidemics would still have to be virtually done if every town in them were placed in the best attainable sanitary condition.

18th May 1885.

No. 7.

MEMORANDUM of the ARMY SANITARY COMMISSION on the REPORT of the SANITARY COMMISSIONER of the CENTRAL PROVINCES for 1883.

1. In these provinces the office of Sanitary Commissioner has been united to that of Deputy Surgeon-General, and as this union involves frequent change of officers, it is scarcely possible for the Sanitary Commissioner to acquire sufficient knowledge of his district to enable him to be of use in the sanitary part of his office. In our Memorandum on the Report for 1882 we discussed the present state of the administration, and perhaps no better comment on its results could be made than is conveyed in the following opening passage of the section in this Report on "Inspections by the Sanitary "Commissioner, Central Provinces," in which the new succeeding officer says, "I cannot find any "notes of the inspections made by my predecessor in 1883, and I took charge too late in the year to "admit of my making any." Of course, this statement implies that for the entire year 1883 our knowledge of the sanitary state of these provinces, so far as this depended on the action of the Sanitary Commissioner, is a blank.

We must, however, take the information, such as it is, and try to make the best of it.

2. The population of 1883 is stated to be 8,817,185, while that of the preceding year was 8,802,040. The increase in 1883 is due to certain minor rearrangements in the districts, and is too small to affect the rates of the year for the whole population. But if taken by districts the additions and subtractions

of numbers would, in several of them, make a considerable difference, as is shown in the following abstract:—

Districts.	Population.	
	1882.	1883.
Murwara	205,307	167,716
Jubbulpore	481,299	525,890
Hoshangabad	488,737	488,594
Nimar	154,677	154,000
Burhanpur	75,446	77,123
Bilaspur	746,130	761,468

3. The births in 1883 amounted to 357,864, or 40·59 per 1,000, which in the light of home experience would be considered a somewhat high rate, although a little lower than that of the preceding two years. If there be no errors in the numbers registered within the registration districts, it is doubtful whether there may not be considerable errors in the population estimates. Eleven districts yielded birth-rates between 35 and 40 per 1,000, and one, Murwara, registered a rate of 54·29 per 1,000. We can form no opinion as to reasons for these rates, but the subject evidently needs to be inquired into, not only on this account, but because of its bearing on the death-rates, which present similar anomalies.

4. The death-rate of 1883 was 34·56 per 1,000, not an excessive rate when we take into account the cholera epidemic of that year. The town death-rate was 35·56 per 1,000, and the district rate was 34·48 per 1,000. But these rates varied in the towns between 14·52 and 78·38 per 1,000 and in the districts between 26·19 and 44·63 per 1,000.

We have already seen that Murwara district registered a birth-rate of 54·29 per 1,000, while its death-rate was 31·35 per 1,000, and then we find, as is shown in the preceding population abstract, that this district had a population, in 1883, of 167,716, while the number in 1882 was 205,307. Judged by the actual numbers of births and deaths registered, the general result is, no doubt, much better than in many other districts in India, but the details throw sufficient doubt on the registration to require some readjustment in the machinery.

5. The total deaths registered in the Central Provinces in 1883 were 304,763, under the following heads:—

Diseases.	Deaths.	Deaths per 1,000.
Cholera	16,235	1·84
Small-pox	4,696	0·53
Fevers	175,119	19·86
Bowel complaints	26,623	3·02
Injuries	4,593	0·52
Other causes	77,497	8·79
All causes	304,763	34·56

We shall next discuss the information about each of these death causes as it is given in the Report and statistical tables.

6. *Cholera.*—Deaths from cholera were registered in all the 20 districts of the Central Provinces, with two exceptions, Saugor and Sambalpur. The latter of these districts is the one which adjoins the cholera endemic area, in which Poori is situated. In Cuttack, Poori, and Balasore districts, cholera prevailed during every month of 1883, and there were 6,631 deaths registered from it, the death-rates being respectively 1·95, 1·26, and 2·12 per 1,000. The average death-rate was 1·88 per 1,000, while the rate for the whole of Bengal was 1·36 per 1,000.

There are 74 towns in the provinces, in 36 of which there were deaths from this epidemic. The country circles, with a population of 8,060,093, had 13,243 deaths, a rate equal to 1·64 per 1,000, and the town population of 757,092 yielded 2,992 deaths, or 3·95 per 1,000, but as half the towns escaped altogether, the rate of those which were attacked must have greatly exceeded this average. Indeed, so far as the attacked towns were concerned, the cholera of 1883 assumed the proportions of a great epidemic. In twelve towns the death-rate exceeded 10 per 1,000, and in one town, Narkher, in Nagpur district, with 7,061 people, 300 died of cholera, equal to a death-rate of 42·49 per 1,000. The town of Nagpur itself yielded a death-rate of 2·49 per 1,000, notwithstanding its excellent water-supply, showing that pure water was in this instance not a complete protection against epidemic intensity.

In the country districts there are 168 registration circles, 87 of which returned cholera deaths, but, notwithstanding the severity of the epidemic, no more than 1,405 villages were attacked, out of a total number of 28,427 in the provinces.

7. In our Memorandum on the Central Provinces Report for 1882, we adduced evidence to show that the provinces were not invaded from the endemic area of Lower Bengal, but from the south-

eastern end of the North-West Provinces, from which the epidemic spread in a broad belt from north to south till it entered the Berars. This was the main line of invasion. There was another invasion through Chota-Nagpur, also from north to south, but the march of cholera along this line was stayed at the centre of the provinces. The map attached to the present Report shows that the cholera of 1882, so far as the chief line of invasion was concerned, covered generally the same ground in 1883 as it occupied in the previous year, but that the second line from Chota-Nagpur had been broken across, and only showed its presence in the centre of the provinces. There appears to have been a neutral period during which no cholera deaths were registered, but when the time came the epidemic appeared generally over most of its old area.

8. The Sanitary Commissioner informs us that "the first reported case occurred on the 16th April, in Seoni district." It may be remarked, in passing, that this district was the earliest occupied in 1882. He then proceeds, "The number of deaths increased steadily in May (there having been only "a very few in April) till August, in which month it was largest, and from which time it rapidly "decreased, the deaths in October and November being comparatively few. The last reported case "occurred on the 17th November, in the Chanda district. . . . The disease did not follow "any particular direction, dying out in one part of the province and appearing in another, but it "increased and decreased at the same time over all the country affected." There was, however, a considerable difference in its severity within the same areas when compared with the epidemic of 1882, and, as the following monthly deaths show, it bore the impress of a resuscitated epidemic, and not of an epidemic invasion :—

Months.	Cholera Deaths.	Months.	Cholera Deaths.
January	4	July	4,425
February	—	August	7,944
March	—	September	1,866
April	4	October	769
May	119	November	176
June	928	December	—

9. We have no means of comparing the monthly climatic elements with the cholera deaths. The mean annual rainfall for the whole province in 1883 was 53·59 inches, against a previous 17 years' average of 49·60 inches. In the rainy season the fall was above the mean, and it will be seen that after the September increase cholera rapidly subsided.

10. Compared with the death-rates from cholera during the last 10 years, that of 1883 took its place in the series as follows :—

Years.	Ratio per 1,000.	Years.	Ratio per 1,000.
1874	—	1879	3·77
1875	1·98	1880	0·04
1876	2·71	1881	1·04
1877	0·46	1882	1·36
1878	5·53	1883	1·84

The great rate of 1878 was related to the famine. The more recent ratios appear to show that a period of cholera increase is in progress.

11. The Report gives a statistical rather than a sanitary history of the cholera of 1883. There are, however, a few notes on the latter subject which may be introduced here. In Chanda district there were 980 deaths from cholera, equal to a rate of 1·83 per 1,000 of the population; these deaths took place in 89 population groups out of 1,634 in the district, or above 10 deaths per group. Two of them were inspected. In one the sanitation was "defective," in the other good, except "foul water round the wells." It seems as if more inspecting and executive work might have been recorded in this case.

In Chindwara district there are 1,350 villages, 155 of which yielded 2,354 cholera deaths, a ratio of 7·63 per 1,000 against a previous five years' average of 0·71 per 1,000 of the total population. The Civil Surgeon inspected 16 attacked villages in relation to this outbreak, and reported that "at the majority of these places the sanitation was very defective, especially at Pandhurna, and he "draws special attention to the practice that exists there, and at neighbouring places, of depositing "the excreta and dirty water in a deep hole filled with stones, close to the well which exists in nearly "every compound. At Lodhikera the state of the water in the river and its pollution by the people, "who use the bank as a latrine, and by the dyers, who throw their refuse into it, is particularly "dwelt upon."

Numbers of villages are reported on as being in an unsatisfactory sanitary condition; but in the cases not covered by the epidemic there was no cholera. It was the presence of the cholera which brought out the deadly consequences of sanitary neglect.

12. But, notwithstanding the presence of cholera, two fairs, Birman and Ramtek, were held and escaped the epidemic. "The Birman fair lasted from the 15th December to the 22nd January.

"The usual sanitary arrangements were in force, and there was not any especial sickness." The total attendance is said to have been 157,171, "the usual daily attendance 60,000, and the number "on the great bathing day being 132,000." There was, however, very little cholera in the neighbourhood where the fair was held.

In Nagpur district, where Ramtek fair was held, there were 4,857 deaths from cholera, and 462 villages out of 1,675 were attacked, so that the cholera was in the country in some force, and Ramtek circle yielded 134 deaths in 33 villages out of 176, and nevertheless the fair escaped the epidemic. "The sanitary arrangements were satisfactory. The area occupied by the visitors to the fair was "divided into blocks; constables and sweepers being attached to each." In this case there could be no doubt of the presence of the cholera epidemic in some force, that many population groups suffered, and that the fair under better sanitary arrangements escaped. This is only part of experience which extends to other fair sites.

13. The epidemic history of 1883 confirms that of all previous epidemics. It has shown that before there can be wide-spread epidemic mortality, there must be cholera, more or less, existing over a country, wherever it may come from. That, when cholera is present, all the population groups do not necessarily suffer. Some, or rather the large majority, escape in any given year, otherwise the country would be depopulated, but the escape of one year is no guarantee for another year's immunity. That local cholera outbreaks are intimately related to filth, damp, crowding, and bad water, but that by preventing these insanitary conditions at fairs, the people are protected from cholera which at the very time may be causing the loss of life in their homes.

14. *Small-pox.*—The following abstract shows the annual mortality from small-pox in these provinces since 1872:—

Years.	Small-pox Deaths.	Years.	Small-pox Deaths.
1873	9,936	1879	25,492
1874	17,696	1880	5,184
1875	26,226	1881	1,876
1876	3,819	1882	3,945
1877	2,768	1883	4,696
1878	16,151		

The figures show clearly the biennial periods of epidemic increase, but the last two years in the series would apparently show a lower degree of intensity of the disease than in the preceding periods of increase.

Small-pox prevailed extensively over the provinces in 1883, as is shown by the fact that deaths from it were returned from 139 out of 168 circles of registration, but as usually happens the whole mortality was yielded by only a small number of population groups, 1,973, namely, out of 28,427, following in this respect the course of all Indian epidemic diseases. Deaths were returned from 35 towns out of 74, some of them yielding only a single death. Out of the total 4,696 deaths forming the year's mortality, 380 were furnished by 757,092 town inhabitants, and the remainder by villages.

The monthly prevalence of small-pox in 1883 is shown in the next abstract.

Months.	Small-pox Deaths.	Months.	Small-pox Deaths.
January	358	July	579
February	384	August	357
March	613	September	195
April	607	October	90
May	630	November	115
June	581	December	187

This table shows the usual increase of small-pox during the hot months. The disease was very generally prevalent in all the registration districts during the year, but some of them escaped in certain months and others in other months. Only in one month, June, were deaths returned from all the districts, and a reference to the preceding abstract will show that June was one of the months of highest mortality.

The vaccination report for 1883 is not included in the year's sanitary Report.

15. *Fevers.*—Diseases classed under this designation constitute by far the most important death causes in the Central Provinces as they do all over India. As already stated, the mortality attributed to fevers amounted to 175,119 deaths, or a death rate of 19·86 per 1,000 for the whole population. To this rate the towns contributed 9,669 deaths, equal to a death-rate for their population of 21·77 per 1,000. The country districts yielded 165,450 deaths, or 20·53 per 1,000. Every one of the 168 registration circles yielded fever deaths. There is little doubt that every village suffered, for fever deaths were reported from 21,982 population groups out of 28,427 in the circles. All the 74 towns had deaths recorded from this cause.

The assigned fever death-rate for five years, 1878–82, was 20·61 per 1,000. The rate in 1882 was 17·31, and for 1883, as already stated, it was 19·86 per 1,000. But, as we shall presently see, not much reliance can be placed on the data.

16. The next abstract gives the monthly deaths under this head.

Months.	Fever Deaths.	Months.	Fever Deaths.
January - -	9,611	July - - -	14,390
February - -	8,896	August - - -	19,250
March - - -	10,159	September - -	20,549
April - - -	11,994	October - - -	19,208
May - - -	13,331	November - -	20,379
June - - -	10,779	December - -	16,573

All that this table shows is that the rainy and drying-up months yield the largest mortality from diseases classed as "fevers."

We shall next extract from the Report such information as it gives on the nature of these "fevers." This is not new, but it is important as another contribution to the subject which had "specially "engaged the attention of Dr. Browne, Civil Surgeon of Hoshangabad, during his sanitary inspec-"tions, and the Civil Surgeon of Chanda also inquired into the deaths reported as caused by fevers. "The result is given below. . . . . Of 77 deaths said to be due to fever inquired into by "Dr. Browne, 32 were apparently really caused by that disease and 45 by others, and of 150 deaths "registered as due to fever investigated by the Civil Surgeon, Chanda, 41 were found to have been "so caused, or only 41 per cent. in the one case and 27 per cent. in the other were actually due to "fever."

The Sanitary Commissioner gives an important table prepared by Dr. Browne to show what may be called the diagnostic error for the chief diseases. It is as follows:—

Total Deaths investigated.	Due to			
	Fevers.	Bowel Complaints.	Chest Affections.	Other Diseases.
365	128	76	61	100
Percentage - -	35·0	20·8	16·7	27·4

If these ratios could be accepted as general they would make an important difference in our estimate of relative death-rates, especially from fever. Thus in 1883, out of a total death-rate from all causes in these provinces of 34·56 per 1,000, which corresponds closely to the previous five years' rate of 34·43 per 1,000, the fever-rate was 19·86 per 1,000, showing that above 57 per cent. of the deaths in 1883 were assigned to fevers. A reference to the preceding table shows that, so far as could be arrived at by a very limited inquiry, the actual fever-rate ought to be 35 per cent. instead of 57 per cent. of the year's deaths, and this correction would reduce the registered fever mortality of 1883 from 175,119 to somewhere about 107,000. But even if we accept this correction as applicable to the whole registration area, we should still have an ascertained fever death-rate of about 12¼ per 1,000 to deal with, which is a third more than has been assigned under the present registration to other provinces of India.

The fever problem in the Central Provinces may be safely limited to this extent without in the least detracting from the paramount importance of these fevers, which the Sanitary Commissioner informs us are "no doubt chiefly intermittent and remittent, due to malaria," to the welfare of the people. The Sanitary Commissioner very properly suggests that this inquiry might be pursued with advantage by Civil Surgeons. These officers make extensive annual inspections, and they could render no greater service to the State than by hunting out the local malarial conditions at the same time and reporting them for removal to the executive authorities.

It follows that, making every deduction for errors in diagnosis, the abatement of fever causes constitutes the sanitary problem of the Central Provinces.

17. *Bowel Complaints.*—Not much need be said under this head, or in regard to the remainder of the disease history of 1883. Deaths from bowel complaints were reported from all the 168 circles of registration, and from 8,743 villages out of 28,427. It follows that these diseases (diarrhœa and dysentery mainly) were very generally prevalent, while their fatality was local. All the 74 towns, with three exceptions, returned deaths from them.

The town deaths were 2,150 in number, or 2·84 per 1,000 of the population, and the country deaths numbered 24,473, or 3·04 per 1,000.

The annual rate for the provinces was 3·02 per 1,000, against a previous five years' average rate of 2·91 per 1,000. The monthly deaths were as follows:—

Months.	Bowel Complaint Deaths.	Months.	Bowel Complaint Deaths.
January - - -	1,219	July - - -	2,913
February - -	1,060	August - - -	4,163
March - - -	1,422	September - -	4,066
April - - -	1,614	October - - -	2,763
May - - -	1,694	November - -	2,313
June - - -	1,615	December - -	1,781

By comparing the data in this table with those for cholera already given, it will be seen that July, August, and September were the months of maximum mortality for both diseases. The Report gives no information as to their local causes. As usually happens, the highest death-rate from bowel complaints was returned from Sambalpur district. It was 12 per 1,000, as against a previous five years' average of 11·33 per 1,000. It would appear as if these bowel complaints at Sambalpur were of local origin, because, notwithstanding the supposed relation of cholera to these affections, Sambalpur District had not a single death from cholera in 1883, and its previous five years' cholera rate had been only 1·42 per 1,000. Bad unwholesome drinking water may be one cause of prevalence of bowel diseases in this district, as the people appear to be infested with worms.

18. Among deaths from *injuries* were registered 655 suicides, 2,560 from wounds and accidents, and 1,378 deaths from wild beasts and snake-bite.

19. Under *all other causes* there were registered 77,497 deaths, or 25 per cent. of the whole mortality, and no account of their causes appears to be forthcoming.

20. *Sanitary Works (Civil).*—The items of expenditure under this head are not given separately, and the total outlay, above 14,000*l.*, was incurred in 19 towns. Of this sum about a third appears to have been spent on conservancy.

The chief improvement to which attention has been given in times past in the Central Provinces has been water supply. There were 172 new wells sunk in the course of the year, and a few wells were repaired. But the whole of this work is of small extent when compared with the number of villages.

Several towns have had their waterworks completed, but the distribution arrangements are still incomplete.

Jubbulpore waterworks were completed, and the water brought into the head-quarters town in July 1883, but the limited provision of hydrants had induced those living at a distance from them to use well water. The deficiency will, no doubt, be provided for, now that the water is there. It should be stated that Jubbulpore appears to furnish evidence of improving health under its sanitary administration. Thus, with a municipal population of 75,705, it had only one death from cholera during the severe epidemic of 1883, and its death-rate from all causes was 25·21 per 1,000, against a preceding five years' rate of 31·99 per 1,000. Its fever-rate of 9·85 per 1,000 is also low.

The water-supply of *Burhanpur* was being extended over the remaining third of the town, and the surface drainage had been improved in some parts of the town. Burhanpur has a population of 36,107, and, notwithstanding its water-supply, the quinquennial death-rate of 33·67 per 1,000 was raised in 1883 to 39·78 per 1,000, of which no less than 9·03 was due to cholera.

The waterworks at *Hinganghat* had been completed, so that now all the people get water from the reservoir, but the mortuary returns exhibit the same results as in Burhanpur. The five years' death-rate of Hinganghat had been 34·77 per 1,000, and it was raised in 1883 to 35·11 per 1,000, of which ratio 6·44 per 1,000 was due to cholera. The population of Hinganghat is 9,000.

The town of *Nagpur* has a population of 98,299. Its five years' death-rate had been 31·14 per 1,000, which was raised to 38·39 per 1,000 in 1883. Its cholera death-rate was 2·49 per 1,000, while the cholera death-rate for Nagpur district was 7·36, and the total district death-rate in 1883 was 44·63 per 1,000, against a preceding five years' rate of 33·66 per 1,000. For a number of years this populous town has enjoyed the benefits of an excellent water-supply distributed over it, and its sanitary condition has been in other respects undergoing improvement. It is not yet in the best practicable sanitary state, but, nevertheless, it can show good results when put in comparison with the district. The fever test is also favourable when applied in the same way. Nagpur town fever-rate was 4·39 per 1,000, against a fever-rate of 9·54 for the district. Part of the improvement in health is, no doubt, due to the waterworks, but the rates are still high for a town under active municipal government, and the result is that there is every reason to anticipate a still lower epidemic and general death-rate as sanitary work, especially cleansing and drainage, is persevered in.

21. Improved water-supply, together with minor improvements in surface work in a few localities, comprehend what is stated as the year's work. Nevertheless, with work of a number of years' duration in providing better water by new wells and waterworks, there are epidemics of cholera. It is not that better water has not been an advantage, but the purest attainable water-supply is only a protection against epidemics due to the bad water it had taken the place of. If other sanitary defects, especially defects in cleanliness, have been overlooked, the deadliest of local causes of cholera will have been passed by without notice, and that such disease causes exist is perfectly well known.

22. In the present Report are given very brief inspection notes by Civil Surgeons, and in several of them attention is called to various sanitary defects, several of which we have already referred to, in their relation to cholera. Thus in *Hoshungabad* district the Civil Surgeon reports that "in *Sohagpur*" conservancy was not well attended to, and the latrine accommodation not sufficient.

At *Harda* sanitation was fairly attended to, but the private latrines were bad. At *Seoni* and *Malwa*, while the conservancy was good, the drainage was "bad." In 19 villages "the wells were not cleaned nor "their mouths protected by a coping." Of 15 villages in Betul four were found dirty and 11 clean. The inspection notes show that a similar mingling of the apparently clean with the visibly dirty is a not unfrequent occurrence.

At *Burhanpur* "the public sanitation was good, but that of the "private houses and compounds "bad."

"In *Bilaspur* itself drainage is bad and conservancy defective. "Fourteen villages are reported, the "sanitary state being in most, unsatisfactory."

In *Mandla* "the Civil Surgeon inspected 33 villages and found them evidently swept and cleaned "for his inspection, but fears only on that account."

Sixty villages were inspected in Narsinghpur. "The Civil Surgeon does not consider it necessary "to give detailed accounts of their state, as it was the insanitary condition in which villages are "usually found."

23. The Native Superintendents and Vaccinators also reported on a very large number of villages. It is considered not to be necessary to enter into details. But the Sanitary Commissioner gives the following as a summary of the different Reports:—

"(1.) Uncleanly state of the interior of the village and its immediate vicinity.
"(2.) No particular place being set apart as a latrine, and so the ground all about close to the "houses being used as such.
"(3.) The housing of large numbers of cattle in the interior of the village.
"(4.) The badly protected state of most wells' mouths, and the absence of a drain to carry off "dirty water from round the well, both causes leading to the pollution of the water-"supply.
"(5.) The defilement of the banks and beds of rivers, the water of which is used for drinking "purposes.
"(6.) Defective drainage."

24. It will be observed that this summary reproduces the results of previous years' village inspections in these provinces. There is nothing new, only the previously detailed sanitary defects are still much as they were. In a previous Memorandum we stated that the defects carried with them their own required remedies. To this the local authorities have replied (as we learn from the Resolution of the Government of India on the present year's Report), "that the difficulties to be "encountered in attempting to deal with these disease causes are really very great, and that, in fact, "there is no more difficult problem than to get the villagers to recognize the insanitary and "unwholesome condition of their surroundings, to revolutionize their daily habits and practices, and "to supply the very considerable sums of money which would be needed to remove even any one of "the causes to which disease is attributable."

25. It is fully admitted that the subject is beset with difficulties, but we feel bound to concur with the following comment of the Government of India on this statement of them by the Local Government:—"There is no doubt," they say, "much truth in these remarks, but it is equally true that if "district officers really interest themselves in the matter, a great deal can be done by their influence "and judicious guidance to improve the surface drainage of villages, to set apart and preserve in "good order tanks or wells for providing pure water to the villages, to keep clean the compounds "and surroundings of houses, and to provide accommodation for keeping cattle as well as for latrine "purposes at a distance from human habitations. It is of the highest importance that the improve-"ment of the conditions under which the people live should be regarded as most intimately "connected with their happiness and prosperity, and that it should not be set aside as a thing which "is practically impossible."

It appears to us to be unnecessary to add anything to this wise judgment on the whole case by the Supreme Government. It involves no outlay for great sanitary works. The people themselves could do nearly the whole of it. Cleansing and keeping clean, with a little spade labour now and then to drain the surface, and very ordinary care in protecting water sources would soon tell on the sanitary state of villages, if the local officers would include these matters as amongst those on which their influence might be brought to bear.

This may may be said to be the practical result of the present year's Report.

26. Before concluding this Memorandum it is necessary to introduce a correction of some remarks made by us in our Memorandum on the Report of 1882, which involved a serious charge of neglect on the part of Civil Surgeons in not having referred in their inspections to the Village Sanitary Code of 1879. The statement was quoted from the Report, but it now appears that from some mistake the Code had not reached the village authorities or the inspecting officers.

1st April 1885.

No. 8.

Memorandum of the Army Sanitary Commission on the Report of the Sanitary Commissioner for the Hyderabad Assigned Districts for 1883.

1. The population of Hyderabad Assigned Districts under registration in 1883 consisted of—

Males	1,358,275
Females	1,271,743
Total	2,630,018

These numbers are taken from the census enumeration of 1881, and would, if accurate, be approximately correct in 1883.

2. The birth and death-rates based on this population were distributed between rural registration circles and towns in the following ratios during the year under review :—

Ratio per 1,000 of Population.					
Rural Circles.		Towns.		Total.	
Births.	Deaths.	Births.	Deaths.	Births.	Deaths.
40·6	51·7	37·4	50·4	40·0	51·4

With these data before us we must hope that the population used as the basis of comparison was much below the truth in 1881, or else that an unexpected increase of population had taken place in the two intervening years. The birth-rate of 4 per cent. for the districts as a whole, rising to 43·2 per 1,000 in Buldana district, and to 51·9 per 1,000 in one of the towns, cannot be accepted without such an amount of caution as to throw doubts on the registration, or on the basis on which the ratios are calculated. We sincerely hope that this latter supposition may be a correct one, otherwise we should have these districts presenting the enormous death-rate of 51·4 per 1,000, taken over the entire population, including in it a death-rate of 55·2 per 1,000 for Amraoti rural circles, 57 for Akola, and 66·1 for Ellichpur.

3. It might be supposed that the town enumerations were more accurate than those of the country districts, but if we concede this as a possibility what can be said about these town death-rates? A list of 29 towns is given in the Report, only five of which had death-rates under 4 per cent. in 1883; all the others exceeded this high rate, and in these the death ratios ranged between 4 per cent and 77·3 per 1,000. The town rates as a whole are the ratios due to a great pestilence, and yet sanitary work has been in progress for years. Upon the whole, while admitting that 1883 may have been an unhealthy year, we should be unwilling to accept, without further and special inquiry, either the accuracy of the mortuary record or the numbers on which the death-rates are calculated.

4. The registered births in 1883 were 105,921, and the deaths 135,081. The deaths exceeded the births by 29,160, showing not an increase in consequence of the high birth-rate, but a decrease of 11 per 1,000 of the registered population. This result, when taken with those already stated, appears to justify a recommendation that this entire subject of population and registration should be inquired into.

This is not the first time that these excessive rates have been brought under review. In 1878 the famine and scarcity year, a death-rate of 81·5 per 1,000 was reported. It was, we believe, found on this occasion that the deaths were registered, but there was no account of any fresh enumeration of the people where this great loss of life took place.

5. It will be seen that too much reliance cannot be placed on the death-rates, as means of comparison, but the actual numbers of deaths are probably more correct, and may be used for such a comparison as the following :—

Returns of 1882-83 in relation to the deaths.

Seasons.	Deaths.		Mean Temperature.		Rainfall.	
	1882.	1883.	1882.	1883.	1882.	1883.
			°	°	Inches.	Inches.
1st quarter	15,730	16,969	19·0	19·0	0·92	0·67
2nd "	15,057	24,813	19·4	22·2	8·73	10·86
3rd "	26,759	67,180	19·6	19·5	18·80	40·87
4th "	19,538	26,119	18·2	17·4	6·23	2·25

The "mean temperature" in this table is probably the monthly or quarterly range, but it is useless. There is, however, a decided relation between the deaths registered and the amount of rain.

The following data, showing the facts of 12 years, are given by the Commissioner of the Assigned Districts, but it will be observed that the death ratios are used in the comparison :—

Years.	Rainfall.	Death-rate per 1,000.	Years.	Rainfall.	Death-rate per 1,000.
	Inches.			Inches.	
1872	38·35	37·1	1878	43·77	81·5
1873	25·44	22·8	1879	38·22	23·7
1874	29·98	27·9	1880	22·96	23·6
1875	34·13	40·3	1881	34·67	29·1
1876	24·70	31·9	1882	29·49	29·4
1877	26·74	29·1	1883	53·14	51·3

It is necessary, in dealing with data of this class, to call attention to such facts as the following:— In 1878, a fall of 43·77 inches of rain was attended by a death-rate of 31·5 per 1,000; while the addition of some 10 inches of rain in 1883 was attended by a reduction of 30 per 1,000 in the death-rate. It would hence appear that some other concomitant cause operates in raising the mortality. In 1878 this cause was famine, and we shall have now to inquire, so far as the facts in the Report may enable us to do so, into the causes which led to the large increase of mortality in these provinces in 1883, beginning with the disease history of the year.

6. The following abstract gives the assigned death causes in 1883:—

Diseases.	Deaths.	Deaths per 1,000.
Cholera	27,897	10·6
Small-pox	3,853	1·5
Fevers	53,593	20·3
Bowel complaints	19,044	7·2
Injuries	1,073	0·4
All other causes	29,621	11·3
All causes	135,081	51·3

This abstract shows that a twenty-fifth part of the people of these provinces was carried off by epidemic diseases in 1883. And the increase in epidemic mortality in this year, when compared with the preceding five years' rates, stood as follows:—

DEATHS from EPIDEMIC DISEASES.

Diseases.	Death-rate per 1,000.	
	1883.	Five Years' Average.
Cholera	10·6	3·2
Small-pox	1·5	0·5
Fevers	20·3	17·5
Bowel complaints	7·2	5·3
Total	39·6	26·5

The epidemic death-rate of 1883 was thus 13 per 1,000 in excess of the preceding five years' average, while it exceeded the corresponding rate of 1882, which was 21·6 per 1,000 by 18 per 1,000. The cholera death-rate of 1882 was 1·4 per 1,000, and the fever-rate was 15 per 1,000, while the small-pox rate was ·1 per 1,000; and the conclusion is that there was a great outburst of epidemic diseases in 1883, to which the very large augmentation of mortality was due.

7. We shall next discuss the disease history of 1883, beginning with cholera, and its previous statistical history, which has been as follows:—

ANNUAL CHOLERA DEATHS, 1868 to 1883.

Years.	Registered Cholera Deaths.	Rainfall.	Years.	Registered Cholera Deaths.	Rainfall.
		Inches.			Inches.
1868	5,447	—	1876	2,683	24·70
1869	10,947	29·23	1877	842	26·74
1870	904	37·63	1878	34,306	43·77
1871	581	19·12	1879	223	38·22
1872	1,578	38·35	1880	1	22·96
1873	—	25·44	1881	3,404	24·67
1874	2	29·96	1882	3,573	39·49
1875	22,465	34·13	1883	27,897	53·14

This 16 years' table gives the law of epidemic cholera in these districts, and it shows that this pestilence attacks the population in the manner of violent outbursts with periods of quiescence. We

have added the annual rainfall, to trace, if possible, any relation which may exist between the amount of rain and the deaths from cholera, but there does not appear to be any such relation, except that in years when the rainfall was heaviest the cholera deaths were most numerous. There are four such years in the table, 1869, 1875, 1878, and 1883, out of 15 for which the rainfalls are given. In these four years the aggregate rainfall was under 33 per cent. of the total rainfall of the whole period, that is, about a third of the rain fell in four-fifteenths of the time, but the cholera deaths in these four years amounted to 87·7 per cent. of the total cholera mortality of the 15 years. This same result has followed comparisons between the total years' rain and the total cholera mortality in the Punjab, where the facts have been ascertained, and any influence exercised by rain on cholera must be sought in the rain distribution when compared with the monthly cholera deaths.

The following abstract shows the facts under this head:—

Months.	Cholera Deaths, Mean of 15 Years.	Cholera Deaths, 1883.	Rainfall, 1883.
			Inches.
January	25·1	30	0·01
February		1	—
March		—	0·05
April	127·7	14	0·04
May	274·8	77	0·24
June	767·9	1,265	10·93
July	1,703·2	20,667	13·20
August	1,825·8	14,534	9·18
September	752·4	1,160	11·90
October	195·0	119	7·66
November	69·5	26	0·28
December	38·1	15	—

This table shows that the monthly incidence of cholera in these districts is pretty much the same in all years. The months of maximum mortality are July and August, but the rainfall of the year covers five months, June to October included. At first sight the monthly rainfall appears to coincide with the monthly mortality, but the coincidence is only partial, and there is no doubt that the fall of 19¼ inches of rain in September and October is attended by a rapid decline and disappearance of cholera. In an undrained country rainfall accumulates as the rainy season progresses, and hence the observed increase of malarial diseases, but in districts where rain cleanses surfaces and tanks, and replenishes wells, continued rain diminishes liability to cholera. This is of course a general statement, for there may be local examples in which rainfall is injurious, even in cholera times; but, taking the evidence furnished by the data as a whole, we should scarcely be justified in adopting the conclusion that in the Hyderabad Assigned Districts increase of rain causes increase of mortality from cholera.

8. We next shall give a brief account of the cholera epidemic of 1883. In the preceding table it is shown that there were 30 deaths from cholera in January, and only one in February of that year. The January deaths were part of the epidemic of 1882, which began in July, and declined to 100 deaths in December, which were followed next month by the 30 deaths in the table. The real epidemic, as the table shows, began with 14 deaths in April, and ended with 16 in December, so that this epidemic, like the same year's epidemic in the Central Provinces, was completed or nearly so within the year 1883. The disease followed a similar course over the area of the Central Provinces and Berar, and in neither area did it bear the marks of an invading epidemic. Cholera was dormant in both sets of provinces, and it followed the history of a resuscitated epidemic in both areas. The invading cholera moved southward in 1882, from Bengal and the North-West Provinces. The following account of the cholera of 1883 is given by the Sanitary Commissioner:—"The cholera of "1883 commenced in the month of April, in the Basim and Amraoti districts. The disease progressed "but slowly during May, being confined entirely to these districts, but in June, favoured by the "approach of the south-west monsoon, the pestilence developed greater activity, and prevailed with "more or less intensity in every district of the province. The first report of cholera was received "from the Basim district, where it broke out on the 16th April, in the village of Wanegaon, in "Unmarked registration circle, situated in the extreme south of the province. On the 24th April "the disease appeared in Amraoti circle of the Amraoti district, almost at the other extremity of the "province, about 84 miles distant to the north."

On receipt of this intelligence the Sanitary Commissioner issued a circular to district officers and Civil Surgeons, warning them of the probable outbreak of cholera, and also warning them to pay strict attention "to cleanliness and general conservancy, and to keeping the drinking "water-supply pure and free from pollution," and suggesting that the attention of municipal committees and of town and village authorities should be called to the subject. "Up to about the "end of May the disease," he adds, "made little advance, being confined entirely to the Basim "and Amraoti districts, but with the first fall of rain in June it began rapidly to develope, "and soon spread over the whole province." We have already seen that there were 77 deaths in May, with less than a quarter of an inch of rainfall, but in June there was a fall of 10·93 inches, and the cholera deaths mounted up to 1,265. Was this a mere coincidence, or did it mark distinct causation? We have no means of deciding, because there are other atmospheric agencies, which in all probability affected the result, such, for example, as temperature suddenly lowered (a known

predisposing cause of cholera in a country where it is already present), and increased moisture of the air with reduction of temperature. Apart from questions of subsoil damp, increase of putrescence in neglected unclean houses, compounds, and villages, and temporary washing of filth into water sources, it is not unlikely that these climatic elements, which are personal in their action, may have aided in developing the epidemic, which, as the following facts show, was one of great intensity and general prevalence.

9. Cholera prevailed over all the six districts of Berar. These districts are divided into 145 registration circles, and cholera was present in 142 of them. They contain 5,564 villages, and nevertheless, true to the law of partial distribution in time and area, the whole of the deaths in 1883 were returned from 1838 villages only. There are 11 towns, with a census population of 138,378, which returned 1,581 deaths from cholera, or 11·4 per 1,000 of the estimated population, a higher rate than that returned for the rural circles, which was 10·6 per 1,000. The comparative prevalence of the epidemic in the districts is shown in the following table:—

Districts.	Total Number of Villages.	Villages attacked by Cholera.		Average Number of Deaths in each affected Village.		District Death-rates.	
		1882.	1883.	1882.	1883.	1882.	1883.
Amraoti	1,047	144	408	9·7	15·5	2·4	21·0
Ellichpur	474	18	265	5·7	19·4	·4	19·0
Wun	1,260	106	251	7·1	11·4	1·9	7·2
Basim	945	29	305	6·7	15·6	·5	13·3
Akola	964	130	373	6·3	15·5	1·4	9·7
Buldana	874	54	236	5·1	12·4	·6	6·7
Total	5,564	481	1,838	7·4	15·2	1·4	10·6

The population groups affected in 1883 were nearly fourfold of those which suffered during the preceding year, while the deaths exceeded a sevenfold proportion in 1883, so that we have another illustration of the influence of epidemic intensity, not only in covering a larger area, but in the greatly increased proportion of deaths in the area covered. The increase of area to the increase of deaths was as four to seven nearly. Similar facts are common enough, and no theoretical etiology of cholera can afford any help towards the understanding of them. They must be accepted at present simply as facts.

10. In a preceding table we have shown how cholera in these provinces occurs in outbursts in particular years, and the present Report contains analogous facts for the districts, which show how very intense the epidemic must have been, in some regions of Berar when compared with others, in 1883, and how much more severe it was in that year than during the preceding five years' period. The facts are contained in the following abstract:—

Districts.	Cholera Deaths per 1,000 of Population.	
	1883.	Previous 5 Years' Average.
Amraoti	21·0	2·3
Ellichpur	19·0	1·0
Wun	7·3	3·0
Basim	13·3	6·9
Akola	9·7	2·4
Buldana	6·7	4·1
Total	10·6	3·2

This abstract shows the relative intensity of this epidemic in each district when compared with the same element during five preceding years. It will be observed that there is no relation between the ratios. The lowest five years' ratio of 1 per 1,000 in Ellichpur is followed in 1883 by a 19-fold mortality. As the local insanitary conditions have doubtless remained very much the same, we are shut up to the conclusion that the great death-rates shown in the table were due to greater intensity in particular regions of the epidemic conditions apart from everything else, or that the liability to death from cholera had increased in some areas more than in others.

11. We have endeavoured to discuss the facts as a contribution to the general history of cholera; but, practically, they also show that, however much insanitary conditions may count for in augmenting liability to attacks of cholera, the warning precautions adopted by the authorities were quite inadequate to protect the people, because the time was past when they could have been of use. If we wish to diminish or remove the sanitary defects in cleansing, draining, water-supply,

unwholesome dwellings, &c., which are known to add so much to the cholera death-rate, so that life may be saved two, three, or five years hence, we must carry out the work now and not then. There are two divisions of sanitary work which must be attended to. First, the work has to be done, and when it is once done great care must be exercised to prevent matters returning to their previous condition. When a powder magazine is on fire it is not the safest time to remove the powder, even if it were possible to do it. The safest thing then is to run away.

12. The earliest cases of the Berar epidemic were considered on the spot to have been due to importation from Poona. A woman arrived at Amraoti district from one of the Poona districts, and lodged on her arrival in a "room" used as a cattle shed. She had a choleraic attack, from which she recovered; but as other cases followed, not in the same house, which was occupied by 16 people but in other houses, this woman was blamed for the importation of cholera, which subsequent inquiry proved had not appeared in the Poona district, from whence she came, until seven days after her arrival at Amraoti. The place where the first real cholera case occurred was Hamalpura, a recently formed suburb of Amraoti. Newness, it would appear, is no protection against sanitary pollution of sites, for referring to the man first attacked, the Civil Surgeon says, "If filth and non-sanitary "conditions produced cholera in him, then he must have met these conditions in Hamalpura. This "place was very dirty, each row of huts having its row of animals alternating with it, the ground "saturated with the excretion of cattle," and yet this place, where "seven cases of cholera suddenly "appeared, is described as a perfect city of Hygeia, compared with Bulgaon itself."

13. The following example taken from Wun district shows the sanitary state of an attacked locality. "In the village of Digras cholera broke out on the 27th (June), where, out of 17 seizures, "9 died. This village was also found in a very insanitary state by the Civil Surgeon, owing to the "number of putrid carcases of cattle lying about. Mr. Chamarette states that the mortality amongst "the cattle was "terrific," and that the village dhers, whose duty it is to remove dead animals from "villages, could not do all the work. It is in such matters that the people of India will not help "themselves. Caste prejudice forbids a Hindu to touch a dead animal, and sooner than help to "remove or bury a decomposing carcase, he will let it rot on his doorstep, or in the stream from "which he may draw his water-supply, until the low caste dher has the time or inclination to remove "it." In this case the state of the village was not reported to the district officers as it ought to have been.

14. We may add the following case from Buldana district, in Deodaba village. Fifteen cases were attacked on the 28th June, three of which proved fatal the same evening. "The village "consists of about 300 thatched and dhaba huts, with a population of about 1,500, and is situated "on low ground, as it is now surrounded by a swamp. All the way to it from the railway station "I had to walk ankle deep in mud. The streets were worse, and a stream was flowing by the "entrance way through a portion of the village. The sanitary state of the village is bad. Cattle "are housed in the village, and house refuse is deposited just outside. The water-supply was "abundant, being drawn from 25 wells. Several of these, however, were submerged during the "late heavy rain, and several admitted surface drainage, not being walled."

15. These examples, taken from different areas of the Assigned Districts, may be adopted as illustrations of the sanitary state, generally at least, of attacked groups of population, and we cannot do better in concluding this history of cholera than to quote the result of sanitary precautions adopted at Deulgaon fair in Buldana. Cholera appeared in this district in June, and yielded the following monthly deaths:—

Months.	Cholera Deaths.	Months.	Cholera Deaths.
June	4	September	250
July	559	October	47
August	2,060	November	11

The fair was to be held at the beginning of October, and in the then known facts about the epidemic the Assistant Commissioner urged that the fair should be prohibited. It was, however, conceived that as the epidemic was declining in the district there would be no risk if suitable measures of protection were enforced, such as "cleansing and keeping clean the area occupied by the people "and their cattle, providing latrines, providing and protecting wholesome water sources, and pre-"venting overcrowding of both men and cattle." This course, advised by the Sanitary Commissioner, was adopted, and the results are recorded by him in the following words:—"The fair was duly held, "sanitary precautions and arrangements for the treatment of the sick were instituted, and the "gathering passed off without the occurrence of any unusual sickness."

In the face of the cholera history we have given for these provinces, this Deulgaon fair partook of the nature of an experiment to show what dependence could be placed on sanitary precautions for protecting human life during a very intense cholera epidemic, and the result was, that while the people died in their villages in the absence of suitable sanitary care, they escaped at the fair where precautions adapted to the circumstances were taken. Surely, it is not necessary to point out the moral.

16. *Small-pox.*—Deaths from small-pox were registered in all the districts and towns of the Berars. In the former there were 3,123 deaths, and in the towns 730. The district death-rate was 1·3, and the town rate was fourfold, or 5·3 per 1,000. The rate for the province was 1·5 per 1,000, or threefold the previous five years' ratio, which was ·5 per 1,000. The year 1883 was hence an epidemic year. The disease was spread generally over the districts, and deaths were registered from it in 117 out of 145 circles of registration, but, as usually happens with epidemics, the whole year's mortality was furnished by a small number of population groups,—only from 608 villages out of a total of 5,564. Every month yielded small-pox deaths, as is shown by the following abstract. The mortality in January shows that the epidemic of 1883 began in the preceding year, but it had apparently come to an end in 1883. The largest mortality was due to the hottest months.

Months.	Small-pox Deaths.	Months.	Small-pox Deaths.
January	386	July	174
February	465	August	68
March	782	September	33
April	861	October	13
May	520	November	16
June	319	December	16

17. The local sanitary conditions which prevailed in affected villages were, no doubt, the same as those already described, and have remained so year after year; but the present Report furnishes evidence of diminution of small-pox mortality, co-existing with better vaccination. This fact is shown in the next abstract.

Years.	Small-pox Deaths per 1,000.	Ratio per 1,000 successfully vaccinated.	Years.	Small-pox Deaths per 1,000.	Ratio per 1,000 successfully vaccinated.
1868	1·9	4·3	1876	0·2	31·1
1869	3·6	3·2	1877	2·9	38·0
1870	·6	7·9	1878	2·7	22·3
1871	0·2	13·0	1879	0·03	29·3
1872	3·8	16·2	1880	0·02	33·9
1873	3·3	14·5	1881	0·08	32·5
1874	0·5	21·0	1882	0·1	38·0
1875	0·4	24·0	1883	1·5	30·3
8 years' aggregate	14·8	104·1	8 years' aggregate	7·53	255·4

This table exhibits several important facts in the local history of small-pox. It shows the distinctly epidemic nature of the disease, and that it recurs with greatly augmented mortality at fixed periods. In 1870 the first period of quiescence began, and it lasted over 1871, to be followed in the next two years by an outbreak during which the deaths were above ninefold more numerous than in the two previous years. This outburst led to three quiescent years, to be followed in 1877–78 by two years of increase and a fivefold mortality. Then came, not two nor three, but four years of quiescence, followed in 1883 by what appears to have been the beginning of another epidemic augmentation. But alongside this history of small-pox the table contains a record of vaccination work, from which it appears that in 16 years rather more than a third of the population (359·5 per 1,000) had been successfully vaccinated, while 22·33 per 1,000 had died of small-pox. The table divides these 16 years into two eight-years periods, in the first of which the vaccinations present an aggregate of 104·1 per 1,000, and the small-pox deaths a ratio of 14·8 per 1,000. But during the second eight years the successful vaccinations had risen to 255·4 per 1,000, while the small-pox deaths had fallen to 7·53 per 1,000, or to one-half. The table also shows that the periods of increase are stationary at two years, but that the periods of quiescence have lengthened, and that, moreover, the death-rates of both periods have been declining. It follows that the mortality from small-pox is normally diminishing in Berar, or else that the vaccination work is telling favourably on the death-rate. To arrive at either conclusion, we should require to know the births, deaths from small-pox, their ages, and the ages of vaccination. The birth element, as we have seen, is at present a doubtful one. If we take it at 40 per 1,000, not one of the highest estimates, we should have for the 16 years an aggregate of 640 per 1,000, or double the whole vaccinations at all ages for the period. But, on the other hand, the vaccination ratios of 33, 32, 38 per 1,000 during the later years came much closer to the 40 per 1,000 birth-rate, if they do not even cover it, were it correctly known.

On the whole, then, the conclusion appears to be warranted that successful vaccination in Berar has done two things; it has diminished small-pox mortality, and by diminishing the number of susceptible subjects it has modified and lessened the severity of epidemic periods on their recurrence.

18. This experience justifies a strong recommendation that the vaccination service should be more specially directed to securing the successful vaccination of infants.

The general susceptibility to epidemics in these districts, which is so high at present, will be also lowered when sanitary work advances. As affording a clue to the localization of both classes of preventive service we shall here give the district small-pox mortality for 16 years :—

Districts.	Small-pox Deaths per 1,000.	
	Mean of 15 Years.	1883.
Amraoti	1·46	2·3
Ellichpur	1·00	1·9
Wun	0·94	0·3
Basim	1·35	0·5
Akola	1·46	1·4
Buldana	1·63	1·9
Means	1·39	1·5

19. *Fevers.*—Deaths registered under this head in 1883 numbered 53,593, of which 27,880 were deaths of males and 25,713 of females. The death-rate was 20·3 per 1,000, against a previous five years' average ratio of 17·5 per 1,000.

Fever mortality was very generally distributed during the year. All the registration circles, 145 in number, returned deaths under this head, and out of 5,564 villages fever deaths were returned from 4,019. Each of the 11 towns in the province returned fever deaths, yielding a general ratio of 17·3 per 1,000, while the rural circles had a rate of 20·5 per 1,000. The following ratios for districts show that the increase of fever in 1883 was general throughout the province :—

Districts.	Fever Deaths per 1,000.	
	1883.	Five Years' Average.
Amraoti	20·7	17·9
Ellichpur	21·6	18·8
Wun	26·9	21·4
Basim	12·2	11·9
Akola	23·4	19·4
Buldana	15·8	14·4

The increase of fever mortality in 1883 was greater over some areas than over others, but whatever was the cause of the increase it was active over all the districts. The fever death-rate during 15 years had averaged for these districts 14 per 1,000, which rate was exceeded by the rate of 1883 by 6·3 per 1,000. Two facts have therefore to be considered, and, if possible, accounted for. First, the fever mortality itself; and secondly, the cause or causes of the rise of death-rates in 1883.

20. We have already dealt with the relation of rainfall to the general death-rates of Berar, and as fevers constitute so large an item in the general rate, it is reasonable to suppose that the amount of rain has an influence on the amount of fever. There are three ways in which the prevalence of fever may come under the influence of the amount of rain in an undrained and imperfectly cultivated country. There is, first, the effect of the annual fall, that is, of the total amount of rain; next, the effect of its distribution in time, namely, its daily or monthly amount; and next, its local accumulation as influenced by the local topography and natural drainage areas. We shall see what information the present Report yields under each of these heads; and first as regards the total annual rainfall. The relation of this factor to fevers has been as follows :—

Years.	Total Rainfall.	Fever Deaths per 1,000.	Years.	Total Rainfall.	Fever Deaths per 1,000.
	Inches.			Inches.	
1868	—	5·2	1876	24·70	18·2
1869	29·23	6·2	1877	26·74	15·8
1870	37·63	10·5	1878	43·77	38·9
1871	19·12	8·3	1879	38·22	14·8
1872	38·35	14·5	1880	22·96	14·2
1873	25·44	8·8	1881	34·67	15·8
1874	29·98	12·2	1882	39·49	15·0
1875	34·18	11·9	1883	53·14	20·3

It is quite clear that, whatever may be said about the annual rainfall as a fever cause, the fever ratios of the earlier years in this table are not to be relied on. Again, the great fever rate of 1878, although co-existing with a high rainfall, was mostly due to famine fever. Leaving out that year it is true that the fever-rate of 1883, which would thus become the highest in the series, co-existed with the highest annual rainfall of the whole series, but then comes in the objection we have already urged

against the reliability of the data upon which the death-rates have been calculated. Taking the cas simply as it stands, the evidence appears not to be sufficient to establish a definite relation betwee the total year's rainfall in these provinces and the calculated fever death-rates.

21. As regards rain distribution, the information is not as full as might have been desired. An average of the monthly fall at 23 stations is given, to admit of comparison with the monthly fever deaths during 1883 in the next abstract.

Months.	Fever Deaths.	Average Rainfall.
January	3,192	0·01
February	2,693	—
March	2,979	0·05
April	4,051	0·04
May	4,919	0·24
June	3,410	10·93
July	5,418	13·2
August	7,278	9·1
September	5,853	11·90
October	4,971	7·66
November	5,008	0·28
December	3,811	—

These data show a large increase of fever mortality following heavy rain, but it is not unlikely that if the local rainfalls could have been compared with the local monthly fever-deaths the connexion of the two events would have been more clearly shown than it is in this average table.

22. We have not the means therefore of connecting local monthly rainfall with the topography and fever prevalence. The only data at our disposal for this purpose are included in the next abstract, which shows the rainfall compared with the fever mortality in each of the districts on a five years' average.

Districts.	Fever Deaths per 1,000, on a Five Years' Average.	Average of Five Years' Rainfall.
Amraoti	17·9	34·92
Ellichpur	18·3	35·62
Wun	21·4	41·90
Basim	11·9	39·10
Akola	19·4	38·72
Buldana	14·4	34·55

The relation between the two sets of figures is not sufficiently obvious to point to any law of fever causation, although in Wun district we have the highest average fever-rate co-existing with the highest average rainfall. It is worthy of remark, however, that the Basim rate, which is the lowest, 11·9 per 1,000, is connected with a rainfall of only 2·80 inches less than the Wun rate.

23. The object of this discussion has been to obtain as clear an account of the facts as possible, and the result appears to be that the fever mortality in these districts is due to other factors besides the absolute amount of rain; and while we admit fully the influence of wet years on the prevalence of fever, we are very desirous that the grave practical error should be avoided of treating the rainfall as an ultimate cause of fever, and so being in danger of neglecting those local causes which alone admit of being dealt with by sanitary measures. We have little doubt that if the towns and villages were placed in a thoroughly wholesome condition there would be a great reduction in the district fever death-rates, but looking at the relation between these rates and the district rainfall, it seems not at all unlikely that the local topography exerts a not unimportant influence on the amount of fever. In the absence of knowledge as to the configuration and drainage of the districts, this is all we should be justified in saying.

24. *Bowel complaints.*—The registration of diseases under this head is of so very uncertain a character that only a few remarks are called for. Deaths from bowel complaints were registered in 143 out of 145 circles, and they appear to have been generally prevalent. They were returned from 2,118 villages out of 5,564 in the province, and every month yielded deaths, although the highest mortality occurred in the later months of the year, as is shown by the following abstract:—

Months.	Bowel Complaint Deaths.	Months.	Bowel Complaint Deaths.
January	817	July	2,871
February	687	August	3,999
March	677	September	2,559
April	800	October	2,049
May	906	November	1,520
June	982	December	1,236

The districts returned 18,411 bowel complaint deaths, equal to a rate of 7·4 per 1,000. The towns returned 633 deaths, or 4·6 per 1,000. The rate for the province was 7·2 per 1,000 against a previous five years' average of 5·3 per 1,000. It seems likely that the higher death-rate of 1883 may have had some relation to the severe cholera epidemic of the same year, as there was a correspondence between the monthly deaths from both diseases.

25. Deaths from *injuries* included 175 suicides, 45 deaths from wounding, 639 from accidents, and 214 from snake-bite and wild beasts.

26. Under "other causes" were registered 29,621 deaths, or 11·3 per 1,000 of the population. The Sanitary Commissioner had made an unsuccessful attempt through the vaccinators to obtain some definite information about them. A similar attempt made in the Punjab has resulted in obtaining important information on the prevalence of chest diseases in that province, so that the object is worth pursuing in the Berars.

27. *Sanitary conditions.*—From what has been already stated it will have been evident that notwithstanding some advance in sanitary improvements the population of the Berars is subject to severe outbursts of fatal epidemics, and one of the problems presented by the Sanitary Commissioner's annual Reports, is that the causes of this epidemic susceptibility should be assigned, and as far as possible removed. The present Report gives a detail of sanitary inspections made by Dr. Little, which ends early in March 1884. There were 72 villages and towns carefully inspected in different localities all over the province, and the result is a very sufficient report and indication of local sanitary defects and disease causes which, no doubt, exist in all unhealthy places, much of the same nature and to a similar extent, although their influence may be locally modified by topographical and atmospheric conditions such as we have already alluded to. Surface cleansing appears to have been attended to in many places, which is, of course, an advance on the former state of matters, but in these provinces as elsewhere in India the real disease causes must be sought within the houses and house compounds. The outskirts of villages are in most cases in a filthy condition from human and animal ordure. Village sites require in certain cases to be extended merely to grant ordinary comfort and convenience to their population. In these villages a great sanitary evil and disease cause is stalling cattle in compounds.

28. A single example selected from each district will give a general idea of these village sanitary problems.

Basim district.—Village Moap. Population, 1,155. "Outskirts dirty, a collection of manure and "refuse of sorts on the road side. On the other side of the village and almost in it are various "accumulations of manure. Inside of village fairly clean, considering that about 800 head of cattle "and 1,500 goats are stalled in it nightly. Best well in a dilapidated state."

Buldana district.—Village Lonar. Population, 2,664. "Patel possesses a copy of conservancy "rules, but they do not appear to be observed. Outskirts of village very foul with human and "animal excrement. Heaps of cowdung, in addition to that put aside for fuel, all round the "village." Road used as a common latrine. "Village inside fairly clean: upwards of 1,500 head "of cattle, are, the patel informs me, stalled in the village at night, and about 500 only are stalled "outside. The villagers, he stated, are gradually stalling more of their cattle on their farms in the "cold and hot weather, but that during the rains they are all stalled in the village." This practice, it will be seen, has a direct relation to the assumed increase of epidemic diseases during the rainy season; out of 10 wells in this village only one contains good water.

Ellichpur district.—Village Takarkhed. "Village very dirty, village sanitary rules a dead letter. "In almost every corner there were heaps of refuse matter, and the bye-lanes are the latrines of the "village." The population of this village is 1,356, and it registered 103 deaths against 67 births in 1883. Of the deaths, 33 were from cholera, 4 from small-pox, 10 from fever, and 34 from bowel complaints.

Amraoti district.—Village Benoda. "The patel and town committee know nothing of the sanitary "rules for villages. The streets of the village were fairly clean, but I noted a good deal of refuse "matter lying about, and accumulations of manure in house compounds. Manure stores or dust-"bins on a large scale outside the village are required." No latrine area set apart. "About 2,000 "cattle are stalled in the village at night, the cowshed being generally under the same roof with the "dwelling-house from which it is separated by a partition wall. Water good." This village has a population of 2,672. There were 126 births registered during the year and 138 deaths, 55 of which were from cholera, and 81 from fever. The other two deaths were accidental, so that the total disease mortality of the year was due to two epidemics, fever and cholera.

Wun district.—Village Kayer. Population 1,695. Village clean. Sanitary rules fairly attended to. This is reputed to be a very feverish and unhealthy village, so much so that it was suggested to the people to remove the village to a more healthy site, but which they will not hear of. The death-rate for 1882 was 40 per 1,000 of population, of which 34·8 were fevers, as compared with 17·6 from this cause for the whole province. The type of fever is intermittent. The people attribute this fever to a stream of water running past the village, but there is also a good deal of irrigated land, a "more "likely cause of the fever." The well water is good.

Akola district.—Village Pathur Nandapur. Population 1,534. "Sanitary rules not attended "to."

Village Kanadi. "Village very dirty. Heaps of dirt and manure in and around village. Patel "has no knowledge of village sanitary rules."

29. The only remark which these examples appear to call for is as follows. The past epidemic history of Berar already stated proves two things,—first, that these diseases have a tendency to recur at stated periods with great intensity; and, secondly, that most of the loss of life takes place in the villages. From the examples we have selected from the Report under review there can be little difficulty in estimating the amount of epidemic susceptibility always present in the 5,564 villages, due in all probability to climatic causes, which of themselves could never account for the facts, but which, with the aid of the prevailing deadly local causes, exert a potent influence on the public health.

It appears further, from the village inspection reports, that certain sanitary rules have been drawn up and circulated among the village patels for their guidance, but in some cases they have been forgotten, and in others neglected. What appears to be wanted are better village executives, for it is quite clear, from the disease history of 1883, that no beneficial influence on the public health can be traced to the exertions of the present officials, under the existing administrative arrangements at least.

30. *Towns.*—We shall add to this abstract, from the village inspection reports, a few notes on the chief towns.

Akola.—According to the census of 1881, Akola town had a population of 16,614. Its death-rate in 1883 was 37 per 1,000, of which 14·5 per 1,000 was due to fevers, and only 2 per 1,000 to cholera, against 9·2 per 1,000 for Akola district. Moreover, its death-rate, 37 per 1,000, during a severe epidemic year, exhibited a marked reduction from the ratio of 45 per 1,000, which ruled during the previous five years. In connexion with these statistical facts, we shall quote the following statement of the Sanitary Commissioner regarding Akola town. He says, "A great deal has been done during "the past year by the Deputy Commissioner, Colonel Fitzgerald, to improve the sanitary condition "of this town. . . . There was a foul and dangerous condition of the house 'moris' and private "latrines. There were no satisfactory conservancy arrangements or supervision of conservancy "establishments, no public latrines, and no system of drainage. Since, however, the Sanitary "Inspection Report of 1881 was written, vigorous action appears to have been taken. Conservancy "and drainage have engaged the serious attention of the municipality, . . . Though much has "been done to improve the town, still it must be remembered that a great deal remains to be carried "out."

In the case of Akola town we have a course of active sanitary work of a simple kind, chiefly cleansing being accompanied by an almost entire immunity from cholera, and by a reduction in the general death-rate from 45 to 37 per 1,000, and we shall next take the case of Ellichpur by way of contrast.

Ellichpur town had a population of 26,728 at the last census. Its five years' death-rate had been 39 per 1,000, but during 1883 this rate had assumed the enormous proportion of 69·3 per 1,000, while the death-rate for the district itself was 65·3 per 1,000. We have already seen that the cholera death-rate of Berar was 10·6 per 1,000. But the weight of the epidemic fell on Ellichpur district, where the cholera mortality averaged 18·5 per 1,000, showing great epidemic intensity. The cholera mortality in Ellichpur town exceeded even the district ratio, and reached 23·7 per 1,000. Premising that the Ellichpur municipality is a poor one, poverty can scarcely be received as a valid reason for the existence of such a state of matters as the following:—"Merely surface conservancy is provided "for. There are no public latrines. Private latrines are not superintended by the municipality, and "owners are said to be held responsible for their cleanliness, which means that they are allowed to "take care of themselves. Besides many, if not the greater number, of these house latrines are "those filthy disease producing abominations called 'peo' latrines, which are merely pervious cesspits "some 30 to 60 feet deep, used by generation after generation. As these get full, or become "unusually offensive, a bag or two of coarse salt is thrown down and the latrine closed for a couple "of days, when it is again ready for use. Of some 1,740 private latrines said to be in existence, "559 of them are computed to be on the cesspit principle." Suppose that in an epidemic country we wished to try an experiment on the localization of cholera, it would not be easy to arrange a better one than this is. There is no analysis of the well water, but it is not improbable that this salting process may have led to brackish well water. Ellichpur stands in urgent need of an organized method of cleansing. All cesspits should be cleared out and filled up at once, and all sewage collected and removed by hand. This is the first work which should be attended to. A good surface drainage system is also required to remove all refuse water due to the projected augmentation of the water-supply. Is it not an imperfect view to take of public sanitary work that, while this deadly condition of the domestic conveniences is allowed to exist, there is an establishment of 16 sweepers and eight carts to clean the streets, where dirt is comparatively of much less injury to the public health than it is in compounds and under the ground occupied by houses?

These two towns are the most populous. The others are large villages, and we shall only select one illustration from among them to show the need of better sanitary administration.

Karatgaon town.—Population, 7,369. "Sanitary rules for villages not known to patel. The "town was dirty. Moris or cesspits abundant, and sullage water from most of the houses runs on "to the streets and filthies the ground around. This is about the dirtiest village I have seen in the "district in this respect. When spoken to about the sanitary rules, the patel replied that the local "committee and not he was responsible for seeing the rules carried out." He was nevertheless a member of the committee, but "there was no unanimity among the members, who seem to be "bickering amongst themselves, and to take very little interest in matters connected with the clean-"liness or health of the town. The patel's house was extremely dirty, with heaps of filth in his "courtyard, dirty mori, and latrine."

31. Of course, in such a state of the sanitary administration, little real work could be done, and the case shows clearly that in these towns there must not only be knowledge of what is required for health, but how it should be done. External pressure might be useful, as it appears to have been in the case of Akola, to the unhealthy state of which we called attention in our Memorandum on the Report of 1881.

32. In certain respects the Sanitary Commissioner reports favourably of the village sanitation. He says, "With regard to the sanitary condition of villages much improvement is manifest in surface "cleanliness, but the provisions of the village sanitary code require more attention," and he points out the following measures, which appear to us to meet the requirements:—"Manure depôts or large "dust-bins situated outside the villages for the reception of sweeping refuse, &c., would be a great "improvement. Extension of village sites where there is over-crowding, some attempt at surface "drainage, and the stalling of cattle apart from dwelling-houses, are the most urgent sanitary "requirements of rural Berar." In our "Suggestions for the sanitary improvement of Indian "stations and their vicinity," we have shown the necessary details for giving effect to economical methods of surface drainage and protection of wells, and to these we are desirous that attention should be directed.

33. *Jails.*—During the last three years a very marked improvement has taken place in the jails at Akola and Amraoti. In 1880 the admissions per 1,000 average strength were 1,046·8 for the former, and 686·4 for the latter. During 1881–82–83 the admissions in Akola jail were 752,322, and 215·2 per 1,000 respectively, and the death-rate, which was 40·3 per 1,000 in 1880, has been since then 12·1, 3, and 11·1 per 1,000 during the three succeeding years. The Amraoti admission rates in 1881, 1882, and 1883 were 708, 297, and 721·4 per 1,000, and the death-rate, which in 1880 was 42·1 per 1,000, had fallen to 17, 8, and 4·9 per 1,000 in the next three years. We have already seen that the five years' average death-rate of Akola town had been 45 per 1,000, and in 1883 it was 37 per 1,000, while the five years' rate of Amraoti town, which had been 23·7 per 1,000, increased in 1883 to 44·2 per 1,000. What has been the cause of this difference in the jail rates? The Sanitary Commissioner ascribes the "marked improvement in the health of these jails to the "improved sanitary condition of the jails with regard to drainage, conservancy, ventilation, over-"crowding, water-supply, and diet,—in fact, to more general attention to sanitary laws."

Jail mortality is subject at times to unaccountable increase, and too much should not be expected from the three years' experience. But here we have two separate groups of people fenced round with suitable measures for protecting their health, and other two groups comprehending the general town and district populations not so well cared for, with the results that, during the great epidemic year 1883, Akola town had a death-rate of 37 per 1,000, and Akola district of 56·4, while Akola jail escaped with a rate of 11·1 per 1,000. In the same way, Amraoti town returned a death-rate in the same year of 44·2 per 1,000, Amraoti district of 54·9 per 1,000, and Amraoti jail 4·9 per 1,000. The facts carry with them their own lesson, just as similar comparisons with jails helped forward the earlier work of sanitary improvement in England, and we must leave them to do so now.

34. *Sanitary Works (Civil).*—These works were partly done by the Public Works Department, partly by municipal committees. To the former belong the conducting of water to the town of Amraoti by a pipe at the estimated cost of 30,264*l.*, which was to be completed in 1885. Two large tanks were also under construction.

In Ellichpur district water was being provided for cattle by tanks and anicuts. In Akola district a tank and two wells were in course of completion, and one tank in Buldana.

There are six municipal towns whose conjoint allotment for all purposes was 16,943*l.*, and their expenditure 15,687*l.* Of this amount 1,742*l.* was spent on conservancy, drainage, water-supply, and other sanitary measures for civil stations. The total expenditure under these heads was as follows:—

	£
Conservancy	5,285
Drainage	1,421
Water-supply	4,430
Other sanitary measures	4,549

Of these amounts there were spent the following for village sanitation:—

	£
Conservancy	550
Drainage	181
Water-supply	1,368
Other expenditures	292
	£2,391

If the amounts expended on sanitary work can be taken as any measure of the possible work done, it cannot be said that it has been commensurate with the necessities of an epidemic country such as Berar. But, indeed, the real work at least in villages, has to be done by the people. So long as such filthy habits and customs exist as those we have only briefly touched on, the main disease causes will continue to act just as they do at present.

That the municipal towns require thorough improvement is shown by the disease statistics, and a comparison with the jail death-rates for corresponding years points clearly to the direction in which improvement should be carried out. So far as we can judge, both municipal and village authorities require very strict supervision to keep them up to their work.

35. Thanks to the Sanitary Commissioner, the disease causes among population groups may be said to be sufficiently well made out to afford ground for practical action, so that the improvement chiefly required in town and village administrations may be proceeded with.

There is one matter, however, connected with the epidemic relation of rainfall which appears to point to drainage defects in sites occupied by towns and villages as those through which the rainfall acts on the public health, and hence general improvements in local relations of sites can be safely advised.

These where necessary, and of a kind to prevent water-logging of the subsoil, together with cleansing and keeping clean, including extension of village sites to enable these all-important improvements to be effectually carried out, removal of cattle from village houses and compounds, and protection of water sources, together with simple impervious surface drains, and the total abolition of cesspits would, so far as we can judge from the facts in this and preceding Reports, soon make a change in the epidemic history of Berar.

Lastly, we must refer for further details to our "Suggestions" already mentioned, but in doing so we have no desire to undervalue the work which has been in progress in past years. All we desire to say is that the disease history in the Report under review shows that it has been insufficient to meet the necessities of the case.

10th April 1885.

No. 9.

Memorandum of the Army Sanitary Commission on the Report of the Sanitary Commissioner for Assam for 1883.

1. The year 1883 is the first year for which the data of vital statistics have been returned for all the districts of Assam.

The total population used as a basis, including that of the Khasi and Jaintia hills, in the present Report is stated at 4,527,934, and the first year's completed results, district by district, have been as follows :—

Districts.	Population, 1881.	Ratio per 1,000, 1883.	
		Births.	Deaths.
Goalpara - - -	446,232	33·39	41·89
Kamrup - - -	644,960	22·56	25·60
Nowgong - - -	310,579	23·91	29·74
Darrang - - -	273,333	21·17	35·71
Sibsagar - - -	370,274	22·49	24·02
Lakhimpur - - -	179,893	18·28	16·27
Sylhet - - -	1,969,009	23·38	25·72
Cachar - - -	289,425	26·73	24·21
Khasi and Jaintia Hills -	43,485	30·19	30·35
Garo Hills (Tura) -	744	59·13	122·31
Total - -	4,527,934	23·91	27·14

The Tura ratios are due to the small population, 744, on which they are calculated, and represent 44 births and 91 deaths.

The first year's completed work gives a general birth-rate of 23·91 per 1,000, and a general death-rate of 27·14 per 1,000, ratios which, if correct, would show a loss of 3·23 per 1,000 of the population on which the ratios are calculated. Both rates are evidently under the truth, but both rates show good registration when all the circumstances are taken into account, and we must hope that as the work has been fairly started, the results in future years may teach us more of the real sanitary condition of the province.

2. Leaving aside the ratios, we find that the births registered in 1883 were 108,269, and the deaths 122,932; the deaths thus exceeding the births registered by 14,663, a loss of population which nothing in the year's epidemic history can in any way account for.

The Sanitary Commissioner also calls attention to the fact that the proportions of births and deaths registered in the districts are subject to considerable annual variations, showing a tendency to relaxation in conducting the work of record. There is, however, nothing in all this to detract from the importance of the registration work already done, while there is every encouragement for aiming at increased precision and greater accuracy.

3. In a former Memorandum we advised that registration of births and deaths should be carried out in the tea gardens of Assam, and the next abstract gives the results for 1883 :—

Districts where Tea Gardens are situated.	Populations yielding Returns, 1883.	Births, 1883.	Deaths, 1883.	Ratios per 1,000 of Tea Garden Population.	
				Births.	Deaths.
Goalpara	1,826	18	42	13·57	31·67
Kamrup	4,806	31	154	16·85	32·04
Nowgong	12,312	222	670	18·03	54·41
Darrang	24,792	438	942	18·47	37·99
Sibsagar	61,519	1,826	2,313	29·84	37·59
Lakhimpur	37,295	310	547	8·31	14·66
Sylhet	27,775	1,091	1,046	39·28	37·66
Cachar	87,266	2,849	2,018	32·64	23·12
Total	257,091	6,885	7,232	26·78	30·97

Referring to these figures, the Sanitary Commissioner remarks that "there seems to be no reason "why the statistics of tea gardens population should not be as near accuracy as it is possible to have "figures, because there must be a muster of all present and an explanation of all absent every day," and yet there are grounds for stating that the mortality in most tea gardens is under reported, "because charitable dispensaries everywhere have the majority of the in-patients from sick tea "coolies who have either deserted from idleness, or to better their prospects, or who have had their "contract cancelled from ill-health, or who are time expired. Such cases in the last stage of "destitution and disease die in large numbers in the dispensaries."

These facts show how difficult it is to arrive at accurate results, but probably some method by means of dispensary returns might be framed from which the registering authority might be able to trace back the numbers and casualties which were due to known gardens. Another and worse reason for inaccuracy appears to be that in certain remote tea gardens there is a temptation to understate the deaths least they should exceed what may be called the Emigration Act allowance of 7 per cent., beyond which there would be Government inspections, and possibly forfeiture of licence.

As these registration questions have been fully raised in the present Report, no doubt they will receive the requisite attention on the spot. As the facts stand, the year's death-rate of 30·07 per 1,000 for both sexes and all ages cannot be said to be high for India, but for a country population engaged mainly in active out-door work, there can be little doubt that it would admit of reduction. We shall return to this subject afterwards.

4. *Death-causes in* 1883.—These were arranged under the customary heads as follow :—

Diseases.	Total Deaths.	Deaths per 1,000 of Population.
Cholera	14,908	3·29
Small-pox	1,462	1·35
Fevers	67,494	14·90
Bowel complaints	14,474	3·19
Injuries	1,292	·27
All other causes	18,655	4·12
All causes	122,932	27·14

The deaths from cholera for the last four years have been returned as follows :—

Years.	Deaths from Cholera registered.
1880	2,803
1881	5,010
1882	21,055
1883	14,908

As the figures stand they would indicate periodical epidemic increase of cholera, now undergoing decline, but this is all that can be said. Cholera deaths were returned from all the registering districts, and from 359 circles of registration out of 678 in the province. There are 18,296 villages, 2,834 of which returned all the cholera deaths.

5. The following abstract gives the monthly deaths for the whole of Assam :—

Months.	Deaths from Cholera.	Months.	Deaths from Cholera.
January	1,362	July	1,184
February	464	August	519
March	854	September	183
April	2,466	October	63
May	3,725	November	247
June	3,464	December	447

But these totals include two affected regions whose topography and meteorology differ from each other in certain important particulars. They are the two great valleys of the Brahmaputra and Surma, the latter of which has a very large rainfall, and is subject to annual inundations during which it is converted into a kind of archipelago. We have discussed this point in former Memoranda in its relation to times of cholera prevalence in the two valleys, and the causative connexion of rainfall with cholera, and we shall abstract from the present Report the results of another year's observations.

Months.	Registered Cholera Deaths.				Rainfall in Sylhet.	
	Brahmaputra.		Surma.			
	1882.	1883.	1882.	1883.	1882.	1883.
January	611	162	406	1,198	—	·13
February	410	102	459	362	2·84	·15
March	839	360	862	491	13·77	5·42
April	1,281	1,064	635	1,897	18·82	5·91
May	3,663	2,516	449	1,161	23·35	36·30
June	2,993	2,380	590	576	27·76	24·19
July	1,424	1,115	187	64	12·60	19·27
August	426	421	182	23	44·92	29·71
September	141	149	243	33	17·68	22·21
October	81	47	782	12	14·81	2·50
November	129	218	1,628	27	·10	—
December	362	396	2,319	48	—	—

The aggregate rainfall in the Brahmaputra valley, if averaged over the observing stations, may be taken at from 70 to 85 inches. The rainfall in Sylhet was 176·65 inches in 1882 and 145·79 in 1883.

It will be observed that the increase of cholera in the Brahmaputra valley was the same in both years, and lasted from March to July, with a slight increase after October. In the Surma valley the increase follows a similar course, but the two histories do not run parallel. So long as the rainfall in the Surma valley keeps the country flooded cholera is in abeyance, but it increases with the disappearance of heavy rain and re-appearance of the earth surface. Of course, over so large an area of country, averages such as these can scarcely be accepted as scientifically accurate, but they strengthen the conclusion enunciated by independent observers that cholera is related to earth surfaces rather than to areas under water, and hence that it co-exists with ordinary malarial conditions, as long ago pointed out by the late Dr. Bryden.

6. That such conditions are always prevalent in Assam, is shown by the constant presence of paroxysmal fevers over the whole country, and their nature may be easily understood by the following statement made by the Civil Surgeon about the topography of Cachar:—"There is, no doubt," he says, "that much sickness is caused by bad drainage, but the configuration of the district is one we "can hardly remedy. The land slopes from the rivers to the interior, whereas in Europe the land "drains to the rivers. The consequence is, there can be no system of drainage here into the rivers, "for the rivers pour their waters into the interior and fill up the extensive hollows which abound. "It is, in fact, the annual floods and the deposit of silt which is gradually raising the level of many "marshes in Cachar. The people are well aware of this fact, and petitions are constantly being made "asking permission to cut leads from the river to low lands, not to drain the land, but to render them "fit for cultivation by alluvial deposit from the river."

Of course, in a country under formation as Cachar appears to be, any attempt at relief by drainage must be of purely local character, and as the topography must be considered as a constant quantity in the sanitary problem, we must look for improvement in the public health to village and household sanitation. We have long since suggested the adoption of raised houses with free circulation of air below the floor, such as are constructed in Burma, as a remedy against the effect of unfavourable topographical locality; but, no doubt, much in the way of local improvements, even as matters stand, might be effected by usual sanitary measures, such as attention to cleanliness and protection of water. That remedies of this class are urgently required is shown in the report of the Civil Surgeon of Sylhet who "again alludes to the notoriously insanitary condition of both urban and mofussil areas throughout "the district. . . . . No move has been made during the year to remedy the admittedly "insanitary condition of the Sadr station." On which the Deputy Commissioner remarks, that "the "town now enjoys local self-government to a full extent, and it is to be hoped that the Commissioners "will not allow private friendships to come in the way of a due discharge of their duty as regards "suppression of nuisance."

7. The introduction of local self-government is of too recent date to warrant us in looking for practical results, but in India we must expect only very partial results from its operation in public health matters unless some means be devised for keeping the local Commissioners to their work. Local self-government is only a means to an end. As a matter of fact, the highest cholera death-rates of the year were returned from towns. Three of them returned ratios exceeding 12, 13, and 44 per 1,000 (Mangaldai). It is of importance to bear in mind the words of the late Sanitary Commissioner, that "cholera is ever present in the districts of Assam. The valleys of the Brahmaputra and Surma are

" alike endemic areas, and no district is entirely free from the disease. Hence the necessity of constant watchfulness over the sanitary condition of the province.

8. The deaths from cholera, district by district, in 1883, stood as follows:—

Districts.	Deaths from Cholera per 1,000 of Population.	Deaths from Cholera per 1,000 of Tea Garden Population.
Goalpara	2·55	16·6
Kamrup	4·08	5·4
Nowgong	5·09	7·6
Darrang	9·11	8·3
Sibsagar	3·09	5·2
Lakhimpur	2·38	4·3
Sylhet	2·58	3·7
Cachar	1·09	1·9
Khasi and Jaintai Hills	2·08	—
Total districts	3·29	4·4

By comparing the district rates with the average total, it will be seen that the flooded districts suffered least from the epidemic of 1883. We have included in this abstract the tea garden mortality in each district. The coolie population is given at 257,091, and the total cholera deaths were 1,106. The average death-rate exceeded that of the district by 1 per 1,000, and the tea garden rates, with one exception, were higher than the district rates within which they are situated, a result which may be due to better registration in the tea gardens. It will be further observed that the tea gardens situated in the flooded districts followed the same course as regards their cholera death-rates as the district themselves, that is they had the lowest rates of the series.

It may be here suggested whether, considering that the tea gardens population is or ought to be under complete sanitary control, such death-rates should be possible. We have too little information about their economy to warrant us in doing more than asking this question.

There is a story or two of importation into the gardens. One of them is from sweetmeats bought from a man whose mother had died of cholera the same day of the garden outbreak. The dates not answering, the sweetmeat seller is supposed to have "probably" travelled in the wake of a body of infected coolies. The Sanitary Commissioner, we are glad to see, makes short work of this matter, and points out that outbreaks of this nature resemble ordinary village outbreaks, and as such are parts of the epidemic. How much more useful it would have been if the garden medical officer had given a detailed account of the sanitary condition of the garden, and the steps taken to remove disease causes.

9. So far as regards the mitigation of cholera outbreaks, the present Report distinctly shows that there are certain things which cannot be done, and that there are other things that lie within our power. We cannot change the topography, but we can improve the house construction in the way we have suggested, and we can cleanse and keep clean the villages and their surroundings, including protection of water sources. Simple as this recommendation may appear to be, it nevertheless involves difficulties in its execution. But these must be met both in villages and towns, by fairly grappling with them. There is in fact no other remedy.

10. *Small-pox.*—Bearing in mind the present state of registration in Assam, the following figures would appear to show a large increase of small-pox in the year under review:—

Years.	Deaths from Small-pox.	Death-rate per 1,000.
1881	3,129	·69
1882	3,195	·71
1883	6,160	1·37

The deaths in 1883 are not likely to have been over-registered to the extent shown by the data, and the presumption is that registration of deaths has been improving, especially as the table which follows shows that the normal increase of mortality followed the monthly rise in temperature, as usually happens:—

Months.	Small-pox Deaths.	Months.	Small-pox Deaths.
January	235	July	403
February	322	August	301
March	606	September	201
April	1,139	October	189
May	1,267	November	180
June	1,089	December	280

Small-pox was more or less prevalent in all the districts, but within the districts only 214 registration circles out of 678 returned deaths. In the same way the year's epidemic was made up of 1,572 village attacks from among 18,296 villages in the province.

Out of 21 towns 12 returned 90 small-pox deaths, or in the ratio of ·90 per 1,000 of the town population, while the country rate was 1·37 per 1,000.

Of the year's mortality, which amounted to 6,162 deaths, there were 1,325 registered as under one year of age, and 3,179, or above one-half, as being under 10 years. The lower town rate is attributed by the Sanitary Commissioner to better vaccination and better medical superintendence in the towns than can be obtained in country districts, in many of which the people object to vaccination, while in some districts the real source of small-pox appears to be the inoculator.

There were 182 small-pox deaths among the tea garden population, or 0·71 per 1,000. Referring to the loss of 31 coolies from small-pox in the tea gardens of Darrang, the Sanitary Commissioner says that it "indicates great disregard both of the lives of their labourers, and of the material interests "of the property," from which it may be gathered that no proper vaccination work is in force for the protection of the coolies, at least in this district, for in the present state of the law compulsory vaccination cannot be applied.

11. There are several interesting points of vaccination experience which may afford guidance in improving the service. For example, the Deputy Commissioner of Sylhet says, "One common "complaint among the villagers is that the vaccinator comes and goes, whereas the inoculator is well "known, and visits the patient frequently until recovery. They appreciate this possibly unnecessary "attention. I think it a great defect in our system of vaccination that the operators are generally "*ticca* men, engaged for the season only, and with no interest in their work, except for that limited "time. They know little, and care less for the people among whom they operate, so that it is no "wonder they fail to gain their confidence and co-operation."

Again, anyone familiar with the discussions on the subject of vaccination which have been current in this country, will be able to appreciate the importance of the following remarks of the Sanitary Commissioner on this statement. He says, while adopting the views of the magistrate, "The mothers "have the entire care of the vaccinated child throughout the operation, as the vaccinator rarely "attends to it, except on his official visit to record success or otherwise on the eighth day, and it too "often happens that the febrile distress, the local inflammation, and the sores which follow abrasion "of the vesicles give these poor people more harass than a modified attack of small-pox aided by the "advice and remedies of the inoculator. During my tour this year at Sibsagar, I happened to see a "group of women and children collected round the bungalow of a tea garden, awaiting the visit of a "doctor. I examined them, and found that they had brought all the children with sores following "vaccination. There were nearly 30 altogether. Probably the lymph had been drawn from a "tainted source, as the sores were of the same description. There had been excessive irritation in "the first instance, the vesicle had been scratched, and not only the puncture been turned into an "ulcer, but the lymph carried on the finger nails to other parts, re-absorbed, and fresh ulcers formed "elsewhere. In this case there was proper medical attendance and relief."

It cannot, however, be affirmed that any part of these unfavourable results can be charged against vaccination. Like every other operation, that of vaccination must have a suitable subject, a definite course and a termination, and neglect of any stage in it is just as likely to lead to mishap as would be the case in other operations. There is a close resemblance indeed between these Assam cases and those we have been accustomed to hear adduced in England as telling, not against the manner in which the operation has been conducted, but against vaccination itself, and the Sanitary Commissioner has done good service by telling us exactly what he saw, and in showing that the real remedy lies in better organization of the whole service, under skilled inspection. It may be further suggested for consideration whether the village inoculators might not admit of being trained as vaccinators, and so render useful public service instead of propagating the disease which vaccination is intended to prevent. Their local knowledge of the people might also be advantageous.

12. *Fevers.*—There is the same difficulty in giving a consecutive account of Assam fevers, as is the case with small-pox, on account of the improving registration of the province, and hence the following three years' abstract must not be taken as showing increase of fever:—

Years.	Fever Deaths.	Fever Deaths per 1,000.
1881	42,553	9·49
1882	60,218	13·43
1883	67,204	14·98

There are no doubt grave errors in the disease classification, but on the assumption that errors of this class are constant elements, the rapid increase of fevers would only show extension of registration. Any way the fever mortality assigned to the wet climate of Assam compares favourably with the higher fever rates of dryer Indian regions. Even in Assam, the wettest districts are not the most liable to fevers, so far at least as can be judged of in the present state of the statistics.

13. In the following abstract we have placed in parallel columns the district fever death-rates and the rainfall at the head-quarter towns for 1883 :—

Districts.	Fever Deaths per 1,000 of Population, 1883.	Rainfall, 1883.
		Inches.
Goalpara	22·28	70·54
Kamrup	17·24	59·27
Nowgong	11·59	73·32
Darrang	15·47	70·85
Sibsagar	11·71	85·44
Lakhimpur	7·90	104·36
Sylhet	12·58	145·79
Cachar	11·41	160·44

The fever deaths registered in Lakhimpur are stated not to be reliable, but in the other cases it cannot be said that excess of rain involves excess of fever-rates.

Local topography must also be credited with part of the fever-deaths, as in the case of the excessive fever death-rate, 22·28 per 1,000, in Goalpara, where the 14,494 fever-deaths returned are stated by the Sanitary Commissioners to have been "due in a great measure to the presence of '*kala-azar*,' a "paludal fever, which has attacked the Garos resident in low lands of the Goalpara subdivision. "The deaths in some of the thanas have been enormous, and quite equal to the worst cholera "outbreaks." He adds, "It will simplify the measures of relief, and the medical treatment also, if "it is accepted once for all that '*kala-azar*' is a marsh ague in its causation, intensified through "chronic relapses into a blood taint, which passes into anæmia and chronic congestions, and that it is "only especially fatal because the sick among Garos are left uncared for, unnourished, and exposed "to continual relapses." No doubt lives might be saved, which are at present lost for want of medical treatment, but the account of this *kala-azar*, or black sickness, which we gave in our Memorandum on last year's Assam Report, shows that it is a very fatal form of Terai fever, prevalent in districts situated at the junction of hills with the low Assam plain, occasionally extending up the lower hill ranges, and causing death by visceral complications of a very intense character.

The only real remedy for such fevers is clearing, drainage, and cultivation, or, as an alternative, removing the people. Like other fevers of the class, this *kala-azar* varies not only in amount in different years, but also in locality, and we learn from the Government Resolution on the present Report that in the following year, 1884, the fever had almost left the Garo hills, but had become very prevalent in the submontane villages of Goalpara subdivision.

"While the Garos lived on the hill summits and near the sources of pure water-supply, they seem "to have had no worse fevers than the Nagas and Khasias have now, but since they have occupied "the villages and submerged tracts with a contaminated water-supply they are very much exposed "to the dangerous form of fever known as '*kala-azar*.'" This statement of the Sanitary Commissioner appears to contain the whole sanitary history of this fever. People living in a mountainous country, with facilities for rapidly removing its rainfall, migrate into a Terai region where the mountain drainage stagnates in the subsoil, and suffer from what appears to be a severe form of congestive marsh fever. This is no more than what ought to take place in an Indian climate, and the facts suggest the remedy. The history would have been otherwise if the Terai had been cleared, drained, and cultivated before the people moved into it, but in its present state the best thing for the people to do would be to leave it.

14. As has been already shown, deaths from fever were returned from all the districts of Assam, and the present Report shows that they were returned from 536 circles of registration out of 678. All the towns reported fever deaths, and 11,191 villages out of 18,296 were affected. The town fever death-rate was 13·28 per 1,000 of the inhabitants, and the country rate was 14·94 per 1,000.

15. The monthly incidence of fever deaths stood as follows :—

Months.	Fever Deaths.	Months.	Fever Deaths.
January	5,324	July	6,638
February	4,461	August	5,657
March	4,259	September	5,855
April	4,776	October	5,452
May	6,344	November	5,598
June	7,233	December	5,897

The highest death-rates in the table are those returned in May, June, and July.

The remark made by the Sanitary Commissioner on these data is as follows :—"The unvaried and "perennial mortality exhibited from a disease which, under sanitary improvements, is known to be "almost entirely eradicable, gives rise to some touch of sentiment, even among the dry details of "periodical statistics."

This is quite true, and the importance of the facts to Indian interests will be better understood by bearing in mind that every one of these fever deaths represents some 20 or 30 non-fatal

cases during the same year, every one of which adds its influence in deteriorating the health and working power of the population. Indian fever epidemics must be reckoned as amongst the most potent causes of Indian poverty.

16. The relation of fevers to the general interest of States has been long known. Immigrants, in clearing the land to supply their own necessities, almost invariably suffer in the earlier years, but gradually the land yields its produce, and in proportion as it does so fever diseases decline in amount and fatality; but the contest has always to be carried on, otherwise the benefits already reaped may be lost, both as regards health and increase. Algeria, in ancient times, was a granary, but under the effects of conquest and bad government it became, at least part of it, one of the least productive and most unhealthy of countries. Now, under better auspices, it has reverted to its proper position as a prosperous colony, and has regained its health standard. But the original colonists who began the work were mostly swept away by fevers.

17. We have no new recommendations to make on this aspect of the question, but we may be permitted to recur to what we have often advised when dealing with these fevers, namely, that although climate is beyond our control, the local disease causes, which climate intensifies, can all be dealt with. Villages can be cleansed and kept clean, cattle can be removed from dwellings. Water sources can be kept free of contamination, and houses can be raised above the ground level, as is done in Burma, with the certainty that there will be a decline in fever mortality and better general health in store for the people.

Before leaving the subject of fever we may state that, out of a population of 257,091 in the tea gardens, there were 1,383 deaths from fever, or 5·3 per 1,000 of the population, a ratio which contrasts favourably with that for the country generally, but part of the result may be due to more accurate diagnosis. The fever mortality was about 18 per cent. of that from all causes.

18. *Bowel Complaints.*—Deaths so registered were returned from all the districts and towns of Assam. The death-rate from them in the districts was 3·17 per 1,000, and in the towns 4·47 per 1,000. Out of 678 registration circles, deaths from them were registered in 506, and the year's mortality was returned from 5,329 villages out of 18,296.

19. The statistics of bowel complaints show a similar increase as those of other diseases. In 1881 there were 9,865 deaths registered under this head. In 1882 there were 14,074, and in 1883, 14,273. The increase, however, is only in the registered deaths.

The monthly mortality was as follows:—

Months.	Bowel Complaint Deaths.	Months.	Bowel Complaint Deaths.
January	1,200	July	1,190
February	963	August	1,211
March	899	September	1,313
April	1,029	October	1,224
May	1,406	November	1,258
June	1,415	December	1,366

20. Deaths attributed to this cause gave rise to 2,036 deaths among the tea garden population, or about 8 per 1,000, while the corresponding rate for the whole of Assam was 3·18 per 1,000. The mortality assigned to this cause was not far from double the loss from cholera among the same population, and was by much the most important assigned death cause of the year. The registration in these tea gardens ought to be more trustworthy, as the people are all under inspection, and it is just possible that bowel complaint deaths may take place at the dispensaries in the way already mentioned which are not accounted for in the garden returns. As this matter evidently requires to be investigated, we shall give the district rates for 1883, with the corresponding tea garden rates.

Districts.	Bowel Complaint Death-rates per 1,000 of Population.	
	Districts.	Tea Gardens.
Goalpara	1·42	4·5
Kamrup	1·89	7·7
Nowgong	3·22	15·9
Darrang	3·66	10·0
Sibsagar	5·12	10·3
Lakhimpur	3·61	3·0
Sylhet	3·64	18·4
Cachar	3·38	4·8
Total	3·18	8·0

So far as we can judge, there is a case presented by this abstract which the officer charged with the local inspections may very well take up and devise a remedy for. Food, water, clothing, shelter, and the general sanitary state of the accommodation may all enter as factors into the origin of these high death-rates from bowel diseases.

21. *Injuries.*—Under this head were registered among the provincial population 82 deaths from suicides, 822 from wounds and accidents, and 325 from snake-bite and wild beasts.

22. Under the head of *Other diseases* the following contrasted facts are of interest:—"All the "Medical Officers speak of scurvy as being practically unknown among the people." And again, "Goitre is common in the Nowgong district near Jagi; hardly a house is free from the complaint."

23. Before concluding these remarks on the disease history of the year, we shall notice briefly the facts stated in the present Report about cholera among tea garden coolies on board river steamers. We discussed the subject in our last year's Memorandum, with special reference to the relation between cholera outbreaks on board these steamers while moving slowly up the river through cholera affected districts on each bank, as against the theory that cholera infected drinking water, which had been adduced as the special cause of these outbursts, was the real cause. The infected water theory may be now dispensed with for all practical purposes. It had been acted on; pure water had been provided, and still there was cholera. A crucial experiment had also been tried by transferring a number of affected coolies to a river flat towed behind a steamer on board which were shipped 547 tea garden labourers. Of the coolies on board the flat, 111 in number, one had previously died of cholera. They refused to accept the pure water, and preferred drawing their supply in their vessels over the side from the river. During the upward voyage cholera broke out on board the steamer ahead among the coolies who ought to have used the pure water, and 16 of them, or 25 per 1,000, died.

None of the coolies on board the flat suffered, although their water was drawn from points in the wake of a cholera infected ship. Suppose cholera had broken out on board the flat. Clearly in public health questions theories can only be used as generalizations of multitudes of carefully observed facts, and no induction from a supposed fact or two ought ever to be admitted. We are very glad to see the enlightened course followed by the Sanitary Commissioner on this important matter in the present Report.

24. We shall next give the year's facts in the following abstract:—

Months.	Cholera Deaths in Districts.	Coolies embarked.	Deaths of Coolies.	
			Cholera.	Other Causes.
January	1,862	1,356	—	11
February	464	1,378	—	8
March	954	3,989	38	20
April	2,466	602	8	3
May	3,725	549	5	4
June	3,464	271	4	1
July	1,184	—	—	—
August	445	—	—	—
September	183	—	—	—
October	63	—	—	—
November	247	290	2	—
December	417	469	5	3
Total	14,998	8,905	62	50
Ratio per 1,000 of population	3·29	—	6·9	5·9

We learn from this table that the death-rate from cholera among the coolies during the brief period which elapsed from the time they were put on board until they arrived at their destination, was double the year's death-rate for the province. The shipments in January and in February escaped cholera, as did also the first shipment in March on board the "Sadiya," although during both months cholera existed in all the districts except two, but it must be noted that, of the 1862 district deaths in these two months, one district, Sylhet, which had nearly two millions of people, yielded 1,460 deaths. The subsequent cholera history follows that of the province. The conclusion would, therefore, appear to be that the ship board population came under similar epidemic conditions as those on shore.

We have no means of knowing the precise periods within which cholera deaths took place among any shipment of coolies. But assuming any reasonable period, and reducing this to an annual ratio, there can be no doubt that the losses from cholera are excessive, and ought to be eliminated. We have to deal, in fact, with very intense local outbreaks of cholera on board ship, where the problems to be dealt with are all much simpler than similar problems usually are on shore.

25. It cannot be said that much additional light has been thrown on the subject in the present Report, but there are, nevertheless, facts which afford a certain amount of guidance now that the water theory has been put out of the way.

For example, the tables show that Dhubri town, with a population of 2,893, yielded 40 deaths, or 13·83 per 1,000 from cholera. Dhubri is now the chief port from which tea garden coolies are embarked, and it may happen that people who arrive there from cholera districts have already the predisposition upon them. The following extract from the Report will show how the disease may be

called into activity there :—"It will be observed that the steamers embarking coolies at Dhubri "during January and February (*vide* preceding table), when there was no cholera in the depôts, "carried them up the river to their destination without any appearance of the disease on board, "although cholera, as shown by the registration returns, was never absent in the other districts of "the Brahmaputra valley. It was not till March, when the depôts at Dhubri had themselves "become an infected area, that cholera also appeared after the labourers had been shipped for river "transport." To this statement it ought, however, to be added that cholera was present in January and February in Goalpara district, in which Dhubri is situated, although in no great intensity. Here, however, we have the case, which is by no means a singular one, of passengers from a country more or less infected with cholera arriving at a place where they were detained, and cholera showing itself among them after embarkation. The "Scinde," to which we have already alluded, with its 547 coolies and 15 deaths from cholera, appears to afford another contrast than the supposed cholera water-infection compared with the history of those 111 coolies on board the flat towed behind her. It is evident that a crowd of 547 people must have led to absence of due separation and spreading while steaming through an epidemic region, and it seems not improbable that crowding was one of the causes of the outbreak. On the other hand, we are told that the deck of the flat "being much "encumbered with cargo, the 111 coolies were not massed in a body, but accommodated in groups "of a dozen or so as the deck space allowed."

The following is a very interesting case because it includes two separate experiences. In the month of March, when cholera was fairly on the increase in Assam, the steamer "Burmah" shipped 211 coolies at Goalundo, the lowest port of embarkation, on the 11th, and proceeded up the river. On the 13th, there was a fatal case of cholera on board, so that predisposition had already manifested itself. Three days afterwards, on the 16th, the steamer arrived at Dhubri, where she shipped 281 more coolies, all apparently in good health, and proceeded on her voyage. Five days afterwards, on the 18th, cholera broke out among the coolies, and continued with some severity until the vessel arrived at Tezpur on the 21st. Here the particular gangs of labourers, among whom the disease had appeared, were landed at the depôt and broken up as much as possible. This measure, with care in the matter of food, clothing, &c., put an end to the outbreak, and the coolies were all forwarded to their destination by a subsequent steamer without further disease. In this outbreak there were in all 13 cases and seven deaths. Do not the facts in this case point to overcrowding and its accompaniments as predisposing causes of cholera? Another steamer, the "Rajmehal," took 423 coolies on board at Dhubri at a time when there were 1,700 waiting in the crowded depôts for shipment, and among whom cases of cholera were of daily occurrence. She left Dhubri on the 18th March, "and there can be no reasonable doubt," says the Sanitary Commissioner, "that these "coolies were put on board affected with disease." Indeed, a case had to be landed before the vessel sailed. Afterwards, cases presented themselves almost daily, and before the vessel arrived at Dibrugarh on the 1st April there had occurred 17 deaths, seven from cholera, six from choleraic diarrhœa, and four from other causes, and then follows this important statement:—"The weather "during the voyages of both the steamers, 'Burmah' and 'Rajmehal,' is said to have been fine "and warm by day, but chilly and frequently varied with storms of wind and rain at night. This "circumstance is noted because the coolies are then apt to huddle themselves together wherever "they can find shelter, and it is possible that local overcrowding to a very insanitary degree is thus "brought about."

But there is apparently a far more potent agent at work also, and this is night chill, which may act with deadly effect on a crowd of predisposed people exposed in this way.

26. Cholera among tea garden coolies proceeding to Sylhet and Cachar appears to be connected with the topography and general sanitary condition of the country through which they pass. They are carried slowly along sluggish streams in country boats, and through malarial districts, while if cholera appears among them it is left to run its course. We concur in the opinion of the Sanitary Commissioner that "the sanitary protection of the tea garden labourers in Sylhet and Cachar "urgently calls for more stringent inspection."

27. We have extracted the facts regarding cholera on board the river emigrant steamers, because they go far to explain the causes which have in times past led to outbreaks during the upward voyages, and the most important of these, as proved by the facts, have been overcrowding of surface on board, want of protection, and consequent night chills. But it is very satisfactory to know that the evils have been minimised by the introduction of an accelerated daily service of mail steamers, which make the voyage from Dhubri to Dibrugarh in four days. By their means crowding of depôts is avoided, the steamers having carried away about 175 coolies daily, for the previous nine months, "without any epidemic outbreak of a severe nature."

The remaining lessons of the past should also be utilized, and these poor people sheltered during the cold nights. These precautions, together with striking off seven or eight nights of exposure on the river, ought so far as the present facts go to remedy the evils which have led to discussions in this and former Memoranda.

28. *Sanitary Works (Civil).*—The expenditure account for 1883 includes charges for medical relief, vaccination, drainage, water-supply, conservancy, disposal of dead, roads and culverts, markets and slaughter-houses, and other sanitary improvements effected in 20 towns, unions, stations, and municipalities. The catalogue of work bids fair, but the total expenditure was only 8,348*l*. There is one heading in the return, and this the most important, under which there is no outlay, and this is "village sites," which involve the real sanitary problems of Assam as they do elsewhere in India. Sanitary progress is nevertheless advancing, though slowly, in the towns. It is very satisfactory to learn from

the proceedings of Government on this Report that steps were being taken for supplying every town with good water on a plan already in use. Foul tanks have been filled up, and the work can be done with profit, as the following case adduced by the Chief Commissioner shows. Mr. Campbell, at Gauhati, "selected a tank in a very insanitary position close to a crowded bazaar, filled it up, and "sold the margin of the tank for building purposes, with the result that he covered all the expenses "of the operation and realized a handsome surplus." Similar results have been obtained elsewhere in India, but it is always necessary to use clean material for filling where the ground is to be used for building. Other works are also in progress, as may be inferred from the following abstract of the Sanitary Commissioner's notes on this subject. These contain both facts and criticisms.

Shillong.—The new water-supply for this town of 3,606 inhabitants, which we described in a former Memorandum, was opened by the Chief Commissioner on 6th September 1883. "No station "in India has now a purer or more abundant water service. But on the other hand, "the conser-"vancy of the station requires more control." Latrine accommodation is still insufficient or non-existent.

Dhubri.—This is a great tea garden coolie depôt, and it is stated that "the drainage, roads, water-"supply, conservancy, medical relief, and disposal of the dead, are all in a very rudimentary condition "in this town." Dead are still buried within house compounds. These facts show what has to be done, but, on the other hand, the municipality "has quite recently been formed, and much sanitary "improvement may be expected from the change." We have already seen that Dhubri is a cholera locality during a certain part of the year, an event attributed by the Civil Surgeon to importation, on which view the Sanitary Commissioner remarks, "So long as sanitation depends on principles of "this kind, local improvement is likely to be deferred. In nearly every section of sanitation the "defects of Dhubri are very great, and it is impossible on the evidence adduced not to 'believe' "the probabilities are much greater the emigrants get cholera from causes in Dhubri than that the "disease is brought by them into the town." Clearly the bad sanitary state of the town requires to be vigorously dealt with.

Goalpara.—The drainage works sanctioned for this town were approaching completion, and much work had been done in improving the water-supply, clearing village sites, general cleanliness, cutting down trees when required to admit light to houses, and many tanks and wells were cleared out. The previous five years' average death-rate of this town had been 53·75 per 1,000, out of a population of 6,697. In 1880 the death-rate was 74 per 1,000; in 1881 it was 64. In 1882 it was 60, and in 1883 the rate had fallen to 43 per 1,000. In this case the advance of general sanitary improvement had been attended by falling death-rates.

Gauhati.—The projected water-supply for this town had made no progress, and the people were still obliged to use bad water. Drainage had, however, advanced, and "was of great benefit in a "sanitary point of view." The population of Gauhati is 11,695. Its death-rate had risen from the five years' average of 27·53 to 30·18 per 1,000, of which 4·96 was due to cholera and 6·67 to bowel complaints. "The municipality has a very able medical adviser in the present Civil Surgeon, and "under the guidance of the Deputy Commissioner money is certain to be laid out with great "advantage to the material prosperity of the town."

Sibsagar.—"The sanitation of this station, the head-quarters of a district, is not favourably "reported. The drainage is unsuccessful, from the trace level being originally defective. There "are no public latrines, and the private latrines are never cleaned. The night-soil is deposited in "deep pits. . . . Jungle tracts and cesspools are in the town near dwelling-houses."

Sylhet Municipality.—The Vice-Chairman's report contains abundant knowledge of the disease causes, and "the comparatively infinitesimal action which follows." Nothing could well be worse than the present state of matters, and the Sanitary Commissioner, after personal inspection, says that the picture cannot be overdrawn. There are no signs of material sanitary progress, but the Commissioners have something in contemplation about byelaws. But what can byelaws do in such a state of matters as the following? "Each resident has a large compound, which he allows to be "overgrown with jungle (it is in this compound he digs a small tank, which he utilizes for drinking, "bathing, and washing); that most residents have no privies, but the jungle in their compounds "they use as their commode." Drains are choked, and dead are buried in compounds. Private privies are never cleansed, except under legal process. In such a case as this every facility should be provided to render improvements practicable before they are enforced.

Silchar.—We are glad to learn that this town, unlike Sylhet, not only knows what is needed, but is doing the work, slowly it is true, but steadily.

The other towns in the list do not present any features requiring notice. The Sanitary Commissioner has done his best to tell us how the work is going on, but there is not much of real effective sanitary progress to record for this year at least.

29. Under the head of *General Remarks* there are some statements made by the Sanitary Commissioner on the subject of sanitary reporting which appear to call for notice. Shortly after the principles of sanitary improvement were introduced in India, it was considered to be very advisable to make use of local Medical Officers for inspecting and reporting, because, amongst other reasons, these officers, from their knowledge of diseases and their causes and from the special training they were to receive at Netley Medical School, were at the time the only reliable advisers in sanitary matters available for the public service. It is true that the Royal Commission of 1859 had recommended the appointment of specially trained Officers of Health, as contradistinguished from Medical Officers, because such appointments presupposed not only theoretical knowledge of the subject such as all medical men possess more or less, but training practically in dealing with sanitary problems, which is a different matter, and it is to officers of this class that the recommendation in our

suggestions applies, namely, that their advice should be taken as a ground for action by the executive authorities. But, besides this special provision of trained officers whose advice could be depended on, it has always been found in practice everywhere, as it has been in India, that there are men with special aptitudes for sanitary work, and it ought to be said once for all that in the course of the last 20 years some of the most efficient sanitary officers in the public service have raised themselves from the ranks of the medical profession in India. It is not to the reports of such officers that the criticisms of the Sanitary Commissioner of Assam apply, but to the kind of reporting usually adopted by Civil Surgeons whose special duties lie in another direction, and who may not be possessed of the qualifications requisite in sanitary officers properly so called. With these explanatory remarks, we shall next see what the Sanitary Commissioner says on the subject.

Referring to the epidemic of 1883, he says, "There is the same tendency observable on the part of "Civil Surgeons to lay the blame of an outbreak on causes outside their particular sphere, and to "speak of it generally as an importation. . . . . I need hardly point out again that such con- "clusions are extremely illogical, that they are simply dogmas, and that the etiology of the disease so "expressed is a vain effort to explain the unknown. Until the precise cause of cholera has been "discovered, it is the most scientific course, in the words of the Government of India, to collect the "facts, to record them accurately, and to draw from them no conclusions except those which are "strictly logical." He further calls attention to the fact that cholera is endemic in Assam, and proceeds as follows:—"The next point that calls for remark is the amount of general information "on the true principles of sanitation which is possessed by all the officers of Government in local "authority outside the medical profession." There are "some sanitary reports, both of town and "country, for the year, which are superior to anything I had expected to receive. I can even go "further, and say the best are certainly not those of the Civil Surgeons, and even where the report is "written by a native of the province holding an appointment, perhaps a magistrate and executive of "some outlying township, there is no question but that he is fully informed as to the true sanitary "principles which are required of his administration. On the other hand, the sanitary reports of "the Medical Officers are intensely impractical." But while saying this the Sanitary Commissioner suggests as a reason probably, that hitherto little active work has followed these reports, and the men get tired and discouraged. The district officers' reports show "a sufficient knowledge of the sanitary "requirements of their charges, but not a corresponding energy in pushing relief projects."

It will be observed that these statements raise anew the whole question of sanitary administration, the progress of which now depends less on want of knowledge than in deficient means for carrying out improvements. There are difficulties enough in the path already, and what the Sanitary Commissioner appears to desire is that these should not be increased by the very easy but very dangerous expedient of throwing the blame of epidemics on causes which are entirely suppositious, a course which in times past has given rise to doubts on the whole subject of sanitary work, while it has discredited the advising officers.

The Sanitary Commissioner sets all this aside, and sums up the local case as follows:—"In the "sanitary reports of every town and district which have so far come under my observation, and, in "every part of the country which I have visited, the conditions under which the people live, are all "of them plainly favourable to outbreaks under all circumstances and at all seasons of the year; and "that there is not a single native community in the province which can, with any common sense, "say of another, 'Thou art the man.'" The evils are general, and so must be the remedies.

There is one very hopeful feature in this matter of reporting, namely, the progress made in it by Native Officers. This should be encouraged, because it may lead to examination and inquiry on the spot, and to the spread of knowledge among the people, and also to local interest becoming developed in questions affecting the health of the several towns and villages,—a matter of the highest importance, for the people are really the proper guardians of their own interest in these matters, and one main object of our work is to assist them on the way to become so.

In conclusion. From what we have said it will be learned that we consider this Assam Report as a very good and useful one. We learn from it that the general and local epidemic disease causes incidental to the province have been made out, and are well known to the Government and its officers, and that there is every disposition to grapple with them if pecuniary resources were available. But even in the present state of matters much good work could be done by the personal influence of local officers, and it is in this direction that further effort might apparently be made with benefit.

We hope that local reporting by Native officers may be encouraged, and that, so far as concerns the reports of Civil Surgeons, they may in future be limited to the statement of disease causes, and to practicable remedies, which, in reality, have nothing to do with recondite disease speculations.

If the "cholera bacillus" were accepted as the cause of cholera, it would make not the slighest difference in the sanitary procedure, because the very existence of this supposed cholera cause would involve the presence of unhealthy conditions, differing practically in no respect from those with which the sanitary administration has always to deal.

18th May 1885.

No. 10.

MEMORANDUM of the ARMY SANITARY COMMISSION on the REPORT of the SANITARY ADMINISTRATION of BRITISH BURMA for 1883.

1. The population of British Burma, on which the statistics of births and deaths in this Report are calculated, consisted of:—

Males	1,947,244
Females	1,706,385
Total	3,653,629

Arranged according to classes, this total was made up of,—

Christians	83,786
Mahomedans	168,757
Hindus	87,802
Burmese or Buddhists	3,210,891
Other classes	102,293
Total	3,653,629

Of this population of 3,653,629 the 16 country districts contained 3,227,854, and 20 towns contained 425,775. The fact is here adduced to show anew that Burmese sanitary work is essentially village work, and that if all the towns were improved there would be little perceptible difference in the general death-rate of the province.

2. In 1883 there were registered the births of 43,066 males and 40,669 females, making a total of 83,735 births, or 22·92 per 1,000 of population.

3. Deaths registered in the same year amounted to those of 29,931 males and 23,652 females, together, 53,583 deaths, equal to a death-rate of 14·67 per 1,000, against a previous five years' rate of 16·34 per 1,000. It is evident that both rates are considerably below the truth. Both are means for the whole country, and both include quite impossible ratios for some of the districts.

There is a great difference in the death-rates of towns and country districts, due probably to better town registration. In 1883 the average death-rate for the 20 towns was 25·50 per 1,000, and for the districts 14·67 per 1,000. These differences, moreover, are constant, as appears from the fact that the previous five years' average town death-rate was 28·40, and for the country population 16·34 per 1,000. In the towns these rates are far more reliable than are those for the country circles, and the town rates at the lowest registered, from 15 to 18½ per 1,000, are not very greatly below a year's average for small populations, and 16 out of 20 towns have returned death-rates which evidently are not far from the truth. It follows that the registration problem, like the sanitary problem in this province, lies among the country population.

4. The following were the registered deaths and the assigned death causes in 1883:—

Diseases.	Total Deaths.	Deaths per 1,000.
Cholera	2,185	0·60
Small-pox	675	0·19
Fevers	26,283	7·19
Bowel complaints	2,781	0·76
Injuries	613	0·17
All other causes	21,046	5·76
All causes	53,583	14·67

It will be seen that the low total death-rate is made up of low disease rates, and that above a third of the year's mortality is not assigned to any disease. The fever-rate is nearest the truth, but this table appears to show defective registration under all the heads. We shall next discuss the information given in the Report under each of the heads.

5. *Cholera.*—Of the 2,185 deaths assigned to this cause, 1,861, or 0·58 per 1,000, were returned from country districts, and 324, or 0·76 per 1,000, from the towns. Cholera prevailed more or less in all the country districts, and in 16 out of the 20 towns. There was a diffusion of cholera of low intensity over the whole country, but its incidence was purely local, for although every district registered deaths, the whole mortality was returned from no more than 89 registration circles out of a total of 843.

In the same way there are 14,811 villages in these circles, and yet the whole mortality from cholera was returned from no more than 126. These facts are common all over India, but it is not a frequent occurrence to have this law of cholera epidemics so clearly exemplified by extreme cases

such as the present. Only three of the districts had death-rates fractionally exceeding 1 per 1,000, and few of the attacked towns had rates below this amount. The disease was more fatal in attacked towns than in districts. One town, Pantanaw, had a cholera death-rate of 2·27 per 1,000; another, Lamyethna, had a rate of 4·11 per 1,000; and the highest rate of the year, 4·62 per 1,000, was furnished by Akyab.

6. The monthly incidence of cholera was as follows:—

Months.	Deaths.	Months.	Deaths.
January	759	July	124
February	281	August	94
March	200	September	107
April	312	October	89
May	185	November	26
June	51	December	7

It appears from this abstract as if there had been part of two epidemics of cholera in 1883, the first having passed over from the preceding year. In January 1883 the disease was present in all the divisions, but was most severe in Irrawaddy. In the same month it showed its presence in all the country districts with three exceptions, but all were visited by the epidemic in the course of the year.

7. The next abstract shows the relation of the cholera of 1883 to that of preceding years.

Years.	Deaths from Cholera.	Years.	Deaths from Cholera.
1872	640	1878	6,759
1873	8,109	1879	1,828
1874	960	1880	2,638
1875	761	1881	5,289
1876	3,678	1882	7,177
1877	7,276	1883	2,185

These figures show a tendency to augmentation of cholera in two years' periods, but the apparent irregular mortality in other years may be due to defects in registration. Nothing can be deduced from the data of practical value.

8. As regards causes of local cholera incidence there is very little information in this Report, due apparently, so far at least as the villages are concerned, to absence of facilities for visiting them. The Medical Officer of Akyab says:—"Neither the writer of the present report, nor his predecessor, had "any opportunities for observing personally the sanitary condition of the district towns and villages, "and unless greater facilities are afforded during the present year than have hitherto existed for a "tour of inspection by the Civil Surgeon, the knowledge at that officer's disposal at the close of the "year will continue to be altogether derived from official documents and correspondence. I am "strongly of opinion," he says, "that arrangements should be entered into to enable the district "Civil Surgeon to make annually a tour of inspection of all the principal towns in his district, and "to submit a report to the district magistrate on the sanitary condition of each, noting specially the "nature of the village site and ground in its vicinity, the progress of vaccination, the source and "quantity of the drinking water, &c., and setting forth any recommendations he might wish to "advance for the removal of what seemed to him prejudicial to the general health, and for the "introduction of such measures as might be beneficial. Furnished with this information the district "magistrate would be in a position to instruct the authorities on the sanitary improvements necessary "to the welfare of their villages."

The details of sanitary inspection and work will no doubt necessarily differ in different districts of India, and it must be left to the authorities to arrange both. But we cannot help feeling that this proposal of the Civil Surgeon involves the leading principles on which sanitary work must be done, and it might be well to follow it up in other parts of the country, if found, in such a country as Burma, to be fairly practicable.

9. The following points are referred to as showing the reasons for cholera attacks:—Coolies from India appear to be very liable to cholera in Burma, possibly from its climatic peculiarities. At Akyab, the first outbreak of cholera took place among coolies. It began on the 1st February, made slow progress at first, but prevailed severely in April. There were among these people 168 cases and 98 deaths. "With the commencement of the rains and the departure of the bulk of the coolies "for their homes (principally to Chittagong) the disease ceased." The reporter says, with regard to this outbreak, that "the men were well looked after, comfortably housed in structures erected after "an improved plan, ventilated and raised from the ground, and the surroundings are kept clean. "Latrine accommodation on the trench system is provided at a distance, and the soil is from time to "time covered up. Drinking water is obtained from the best wells in the neighbourhood (no "analysis given). Of course it is impossible to say that this is used by every one." It is further stated that the town residents, although living under more insanitary conditions than the coolies, escaped. It might have thrown more light on this coolie outbreak if the size and cubic space per

inmate in the coolie barracks had been given, because it is known that mere proximity of a considerable number of people, without adequate subdivision, may cause an outbreak of cholera among the susceptible, even in the absence of notable sanitary defects. It is mentioned in the present Report that when cholera attacks people in a place they escape by simply running away and leaving the sick.

10. A second outbreak of cholera took place in the town of Akyab itself on the 3rd July, chiefly confined to Moulapara, "one of the most insanitary parts." After it ceased in the town it attacked the prison. The epidemic was confined within the jail walls, while the neighbouring villages escaped. It ceased on removal of the bulk of the prisoners, and the Medical Officer remarks that "a jail, "however sanitary its condition, is therefore liable to attacks of cholera in an infected and insanitary "neighbourhood. Desert the spot appears to be the watchword for any future outbreak." During the July outbreak there were in all 74 attacks and 59 deaths from cholera.

This Akyab epidemic has afforded additional experience on the dangers that may accrue during cholera invasions from agglomeration of people, and also the necessity of avoiding all such crowding.

11. The Sanitary Commissioner makes the following remarks on the cholera in Prome district. "A peculiar coincidence" is noted by the Civil Surgeon as having occurred at a brickfield, where some cases appeared among the coolies, and "a change of water-supply from the adjacent stream to "the river put an end to the epidemic." But the Sanitary Commissioner very properly states that "if cholera is due to a microzyme introduced into the system in the water for the most part, it is "difficult to understand how the plague can become epidemic in certain villages on a running stream, "whilst others lower down escape." It is more satisfactory to learn that Prome itself had very little cholera, although it is usually afflicted by this plague, and that "the sanitary conditions of the town "have greatly improved."

There is nothing more requiring notice in the history of this year's cholera, except that it is very satisfactory to see that the reports have been mainly concerned with the relation of sanitary defects to cholera, although they would have been more useful if more detail had been given.

12. *Small-pox.*—The following abstract shows the deaths from this disease, together with some details as to age, since 1877:—

Years.	Deaths.	Ages of Children.	
		Under one Year.	Under 12 Years.
1877	1,230	73	205
1878	1,406	222	381
1879	2,297	487	1,147
1880	5,402	921	2,902
1881	1,765	342	838
1882	770	134	372
1883	675	104	365

The small-pox mortality of 1883 was the lowest on record. The rate was ·19 per 1,000 of the total population. The large proportion of children carried off by this disease clearly shows the necessity for directing vaccination work more to the protection of infants than of adults. If the registration could be depended on, we should have to admit that the district death-rate, 0·14 per 1,000, where vaccination is not likely to be very perfect, was only about a fourth of the town rate, 0·54 per 1,000, where vaccination ought to be more extended. In this as in other instances it seems probable that registration has been at fault. Out of 20 towns, nine only reported small-pox deaths, 232 in number, and of these deaths 152 were returned by Rangoon. The disease was present in all the divisions of the province, but of 16 districts six escaped altogether. Out of 343 circles of registration, small-pox deaths were registered in no more than 34, and the whole year's mortality took place in 27 villages out of 14,811 in these circles and districts. We have here another example of a disease which existed over the whole area of a large country being confined as to its mortality to 27 spots only.

The monthly prevalence of small-pox was as follows:—

Months.	Small-pox Deaths.	Months.	Small-pox Deaths.
January	30	July	52
February	93	August	45
March	92	September	31
April	74	October	48
May	71	November	45
June	67	December	77

13. *Vaccination.*—The following abstract gives the vaccination service and its work for 1883. Under the superintendent there was the following staff:—

Native superintendents	3
First class vaccinators	17
Second class vaccinators	43

The total vaccinations performed during the year were 73,269, of which number 61,901 were reported successful, and the influence of the year's work on arresting small-pox may be estimated by the following statement of the Sanitary Commissioner :—"Of successful cases among children, there "were 8,831 under one year of age, about one-ninth of the number born." This one fact shows where the vaccination service requires direction. It is unnecessary to pursue the subject further, especially as the Report itself is chiefly occupied with the usual departmental details of the vaccination, which do not require notice.

14. *Fevers.*—As usually happens, diseases classed as "fevers," although less fatal in British Burma than they are in India, constituted the principal registered causes of mortality in 1883. Fever deaths were returned from all the districts and towns, and the aggregate year's mortality was 7·19 per 1,000, against a previous five years' rate of 8·41 per 1,000. Of this aggregate rate the districts returned 7·019, and the towns 8·57 per 1,000. The district rate represents the village mortality. Fever deaths were registered in 559 circles out of 843, but here we have again the anomaly that all the country fever deaths were returned from no more than 1,364 villages out of 14,811, although the other data show that fever prevailed over the entire province.

15. We have endeavoured in previous Memoranda to discuss the climatic causes of Burmese fevers, but without much success, on account of the great differences in the elements of climate in different districts. The Sanitary Commissioner has given the following data, which may be introduced, not because they show the whole case. They are, however, all that are available for the whole area :—

Months.	Fever Deaths.	Average Rainfall.	Humidity Average.	Mean Temperature.		
				Max.	Min.	Range.
		Inches.				
January	2,846	—	58·92	85·24	58·62	26·62
February	4,984	0·18	56·54	90·04	61·39	28·34
March	1,909	0·09	55·54	94·24	68·10	26·02
April	1,721	2·09	59·69	95·07	72·97	22·02
May	1,658	9·68	78·00	92·88	75·19	17·74
June	2,145	28·53	85·46	86·46	75·07	11·29
July	2,524	33·59	86·92	85·11	75·06	10·00
August	2,750	22·72	85·69	86·12	75·43	10·69
September	2,803	19·41	83·93	86·16	75·86	10·31
October	2,086	6·54	75·57	88·75	73·61	15·29
November	2,104	6·62	78·86	86·23	70·75	15·48
December	2,058	0·91	70·29	83·45	64·60	18·92

Apparently, when treated as averages, the fever-rate increases with rain and a high rate of humidity, and with high temperature, but then we have the seaside climates, with their excessive rainfalls, much above the average for the whole country. The data in this table can scarcely be said to throw much light on fever prevalence, and, besides, we have been taught by past experience of fever causes that these may be connected with merely local rainfalls, acting on the public health through the agency of local topography and local insanitary conditions. Burmese experience shows that local climates and other local causes influence materially the amount of fever. Thus Arakan division, which has an excessive rainfall, yielded the highest fever mortality, namely, 11·75 per 1,000, while Tenasserim division had a fever-rate of only 5·35 per 1,000 in 1883. These differences are not casual, but represent different rates of fever susceptibility, which it is of great importance to inquire into, because upon our knowledge of the causes depends very much our ability to deal with these fevers practically.

We may give an illustration or two of the relation of fever to rainfall in the districts in 1883. The maximum rainfall of the year was registered at Sandoway. It was 223·09 inches, and the corresponding fever death-rate was 11·45 per 1,000. At Akyab the rainfall was 197·07 inches, and the fever death-rate was 12·02 per 1,000, but under the five years' average, which had been 16·23 per 1,000. Thayetmyo, with a rainfall of 51·27 inches, had a fever-rate of 10·50 per 1,000. Its previous five years' mean rainfall had been 40·92 inches, and its fever-rate 12·04 per 1,000. The lowest fever-rate for the year, 3·41 per 1,000, was registered in Thongwa, while the rainfall of Irawady division, within which it is situated, was between 51·27 and 106·32 inches. The general result appears to be that rainfall acts on local fever causes, and is not in itself a cause.

16. There is no information about local fever causes in the present Report, except as regards Rangoon, which has afforded some interesting experience on the influence of these causes, from which the fever mortality has been rising. In 1882 it was 8·36 per 1,000, and in 1883 it was 10·58. The reasons given are as follow. Rangoon has grown up rapidly and irregularly, and on no fixed plan, and the influx of labourers to meet demands of employers has exceeded the health capabilities of existing accommodation. Labourers employed by firms are better lodged than squatters, whose huts are built immediately over swamps, and both suffer, especially the latter. "The fever is of the "ordinary intermittent and tertiary type. The natives of India suffer most, but Europeans and "Burmese are often affected."

All this leads to loss of labour, and consequent pecuniary loss to employers, and it is said of one firm that in the last quarter of the year they had 17 per cent. of their men on the sick list, involving a loss of 8,644 days' labour. The results of these fevers to the poor people are described by the Health Officer as follows:—"On the 28th and 29th June I visited in all some 52 houses, and found

" nearly a hundred men, women, and little children ill with fever in different degrees of severity. In " some houses whole families were down, and most distressing scenes were witnessed. . . . . " Twenty cases had been suffering for longer than a month, while a few were utterly prostrate, and " in an almost hopeless condition. The fever was generally intermittent." It had, however, a tendency to become remittent. "I believe," he says, "the fever to be of malarial origin, and entirely " due to the fearfully insanitary state of the neighbourhood.

" The spot is typical of what exists in many parts of the district; the houses, most of them of " bamboo, are built over the broad shallow trenches by the roadside and on the adjoining low ground; " the tidal water runs under all the houses, but the mud is exposed for 22 hours out of 24. There " are no latrines, or attempt at conservancy possible, and pigs abound in numbers. The stench " from the putrid mud beneath the houses is at times unbearable. . . . At the end of the rains " in 1880 the people in this same group of houses suffered terribly from malarial and typhoid " fevers."

Here we have one of a class of cases in which people have been left to their fate. We shall follow this up by another in which an effort had been made to protect them. The Officer of Health states that, within a stone's throw of the spot we have described above, " may be seen on the estate " of Messrs. Rowett & Co. what has been done by private enterprise." This is described by Mr. Rowett as follows:—" We began operations about two years ago on lot No. 11, measuring about " 15 acres. At that time the land consisted mainly of swamps and old tanks containing stagnant " and unwholesome water. There was a mound at one corner which had been the site of an old " pagoda long since removed. A few straggling mat-shed houses ran along the creek bank, inhabited " mostly by boatmen and fishermen. Since then we have landed many thousands of tons of ballast " of various sorts, sand, stone, shale, mud, &c. We have removed the mound, which consisted of " shingle and ferruginous clay, brick, &c.; with these materials we have filled in the old tanks, and " raised most of the land until it is fit for good healthy building sites." The land had been laid out in plots to be leased for building. The reclamation was a good work, but in all such reclamations it ought to be remembered that a suitable site for human dwellings requires other things besides reclaimed area. It is not enough, as in the present case, to lay out roads for access to the building plots. The *whole* area should be drained, otherwise time and occupation of area will lead to saturation of the ground and consequent epidemic diseases. But the Officer of Health is right in adducing this case to show what can be done. And in his view, " the future reclamation of this " important district must be carried out by some such method, whereby deep water and serviceable " land may take the place of the many acres of pestiferous swamp which now exist." But care must be taken that only clean and wholesome materials are used for filling in, otherwise the last state may be worse than the first, if the reclaimed area is used for the erection of dwelling-houses.

17. The case of Dala, which we referred to in our last Memorandum, is again discussed in the Report under review, not so much in its sanitary relations as in the administrative course adopted. After describing the abominable condition of the locality, we asked the question " why such things " are allowed to exist?' and we stated that " somebody must be to blame," and we are now told that, " in December 1882 a petition was presented by a number of Burmese residents of Dala, " complaining that a large tank, upon which they were chiefly dependent for their supply of " drinking water, was fouled by squatters near its banks, and who kept ducks and geese, and washed " their clothes and bodies in the tank." The ground, which had been kept clear of dwellings by the Burmese to preserve the water from contamination, was occupied by squatters, and, after inspecting the condition of the place, the Officer of Health reported that the huts of these squatters should be removed, as there was plenty of vacant land where they could be re-erected. The Deputy Commissioner concurred in this proposal, and orders were passed for the men to move their dwellings. Nothing, however, was done, and on a subsequent petition from the Burmese being presented, " it " was found that the Commissioner of Pegu had curtly cancelled the orders of the Deputy Commis- " sioner, and given the men permission to stay." And, as a consequence, " the place is now in a far " worse condition than it was," for the huts have " been enlarged and extended, and on my last visit " I found them crowded by some 200 men." He further says, " The most filthy parts of Dala are " those occupied by the natives of India, and it would not be difficult to point out nearly a dozen " bustis and villages inhabited chiefly by those people which the officers in charge of the land have " allowed to spring up within the limits of the municipality and cantonments during the last few " years," and all this without " scavengering, conservancy, or drainage, ventilation, or prevention of " fire." The Commissioner of Pegu has evidently not been acquainted with the real facts of the case, or he had no power to interfere; any way it is self-evident that the water supply of the Burmese must at any cost be protected, and that the erection of Indian emigrant huts and their sanitary supervision must be put under control. As many as 60,000 of these poor people have arrived from Bengal and Madras in a single year. They crowd into the worst parts of Rangoon, foul every spot of ground about them, and yet we are told that " to mitigate some of these evils the Municipal " Committee submitted to the Chief Commissioner, for approval, a simple byelaw against over- " crowding similar to the clauses in the Municipal Acts of Madras and Bombay; he, however, " declined to sanction it."

18. It is possible that the proposing of such a byelaw was *ultra vires* of the municipality, and if such were the case, it is clear that they should have such a power conferred on them. That power of dealing with these pestilential localities should be lodged somewhere and actively exercised there can be no manner of doubt. And then we have the following statement of the first result of the new municipal constitution, which it is worth while to quote entire to see whether some remedy cannot

be found for its deficiencies, so far, at least, as it concerns Rangoon :—"The delight with which the "European community at least hailed the scheme of local self-government arose from the expectation "that much more would be done for the health and cleanliness of the town than in the past. But it "must be emphatically affirmed that the members have given sanitary matters a large share of their "attention, only to find to their bitter disappointment and discouragement that they are almost power-"less, and that the obstacles to improvement are not those which spring from opposition of ignorant "classes to civilized innovations, but from the carelessness of local officials and former committees in "allowing the city to grow up in an insanitary condition and the neglect of higher authorities to "provide good municipal laws. To the latter cause must be ascribed many of the evils spoken of "in this Report. For years the most important byelaws could not be enforced without troublesome "litigation, which so frequently terminated to the disadvantage of the municipality that an impression "seems to prevail throughout the community that the byelaws are illegal." Many of them have been declared to be so, although drawn up by the Government advocate. And the result is, we are informed, that the Committee have decided to await the passing of a new Act; and the Chief Commissioner himself has stated that "Rangoon is behind many cities of India in sanitary matters." At the time this Report was drawn up the whole sanitary administrative arrangements appear to have been in a state of chaos, requiring a strong and skilled hand to put them in order. We are glad to see that the Supreme Government has called pointed attention to these matters, expressing at the same time their opinion that "it is evident that if any sanitary improvements are to be accomplished, a more "rapid and decided procedure must be devised." Probably this remark will be found applicable to other fever localities besides those in and about Rangoon.

19. *Bowel complaints.*—These diseases (diarrhœa and dysentery) have given rise to the following registered deaths since 1872 :—

Years.	Bowel Complaint Deaths.	Years.	Bowel Complaint Deaths.
1872	4,893	1876	4,640
1873	5,099	1879	3,332
1874	4,860	1880	3,500
1875	5,212	1881	3,808
1876	5,269	1882	3,291
1877	6,879	1883	2,761

Bowel complaints are more common among natives of India than among Burmese, and are attributed partly to sleeping on the ground by coolies and partly to starvation. The total death-rate from them was ·76 per 1,000 against a previous five years' rate of 1·14 per 1,000. The district-rate was ·54 per 1,000, and that for the towns 2·44 per 1,000.

Bowel complaint deaths were registered all over the province, but were limited to 111 out of 843 registration circles, and the whole mortality was returned from 116 population groups out of 14,811. The results are so manifestly unreliable that no further remark is required.

20. *Injuries.*—There were 613 deaths, including 45 suicides and 225 from wild beasts and snake-bite registered in 1883.

21. *All other causes.*—Deaths entered under this head numbered 21,046, or 5·76 per 1,000. The largest ratio of deaths so registered was returned from the towns.

22. *Sanitary Works (Civil).*—Under this head the expenditure on sanitary works and measures for the year 1883 is given for 15 towns, and the following abstract shows the total outlay under each head. The amounts include new works and repairs, but chiefly the former :—

	Rs.
Water-supply	67,920
Drainage	2,987
Scavengering	—
Latrines	6,637
Urinals	—
Markets	112,003
Burial grounds	10,412
	Rs. 199,959

To one of the most important of sanitary measures, namely, cleansing, it appears that no money was devoted in 1883, and although the heading is retained in the statement of sums allotted for the following year's services, there is none for scavengering. It would be better to leave out the heading altogether, for we cannot suppose that no cleansing work was done. It appears to have been otherwise provided for. In the case of Rangoon, it is stated in the town report that Rs. 61,500 was sanctioned for day conservancy, and Rs. 59,600 for night conservancy.

Rangoon has now got its water-supply delivered from hydrants in all the principal thoroughfares, but part of the population still derives its supply from polluted brackish wells, although the new water is preferred. Evidently the next step to take in this matter is to fill up the sewage polluted

wells. There is one matter which appears to be connected with popular habits, apparently admitting of some improvement. It is stated that "bathing and washing of clothes is often carried out at the "stand pipes, rendering their vicinity insanitary and involving much waste of water." These two evils are not consequences of a better water-supply, and they ought to be prevented, and suitable places for both purposes provided. Drainage in Rangoon is still dependent on deep brick channels and surface drains. This large town has still to be drained apparently. The present works are described as follows:—"Surface drains have been improved, and 6,567 lineal feet of drains "have been constructed during the year at a cost of Rs. 36,600. Many streets have been made up "and metalled with laterite. Drainage spaces are being improved, and to the east 10 acres, and "west 20 acres, have been reclaimed." This is satisfactory so far as it goes, but it may be suggested whether the time has not arrived for providing a proper drainage system in connection with the water-supply so that the added water may not become an added disease cause.

23. In the course of the year the Sanitary Commissioner, in the routine of his other duties, visited and inspected 19 towns, and he has given a brief abstract of the results, which, as he states, he also entered in the dispensary books for the information of the authorities, a very proper step, if they only act on it.

The abstracts give a brief general account of the leading sanitary points of conservancy, drainage, water-supply, &c., and the general impression produced by the facts is stated to have been that "there is, of course, in most, much room for improvement, but as will be seen from the summaries "given under sanitary works, much well-directed activity is being displayed."

It will save repetition, if it be stated that water-supply is being improved in many towns by cleansing and deepening wells and bringing in other sources of supply. A scheme for a new water-supply and drainage of Prome has been sanctioned. Drainage is chiefly carried out by surface channels, cleansing is more or less efficiently attended to, but the cesspool system with its dangers still exists, which, as the Sanitary Commissioner states in the case of Akyab, "grow graver yearly." The evils and their remedies have been fully described in our "Suggestions for the sanitary improve-"ment of Indian stations and their vicinity," and we must refer to these for such information as may be required for dealing with them.

It will be seen that the whole year's work refers to towns, and that village sanitation appears to be still a matter for the future.

In conclusion, as we have on former occasions expressed our opinions freely on the defective condition of sanitary administration in Burma, so in the present case we must state that the Sanitary Commissioner appears to have done a good year's work in the midst of his non-sanitary duties. But the present Report contains sufficient information to show that sanitary improvement in the province has scarcely as yet gone beyond the tentative stage, and even this a very limited one. We know enough, however, to enable us to make a strong recommendation that the sanitary administration in Burma should be taken in hand and carried out vigorously, and to enable this to be done executive officers should have sufficient legal powers conferred on them. Far better have no sanitary laws at all than deceptive enactments which exist at present only to impede all progress, and this may be said to be the chief practical teaching of the present Report.

With reference to the statement in the last paragraph, we desire to add that, since this Memorandum has been prepared, we have been informed that, as regards Madras coolie lodging-houses, the legal difficulty has been removed by the Burma Municipal Act, 1884, which empowers local committees to make rules "for fixing and from time to time varying the number of persons who may "occupy a building which is let in lodgings, or occupied by members of more than one family; for "the registration and inspection of such buildings for the notices to be given, and precautions to be "taken in the case of infectious diseases breaking out in such buildings, and generally for the proper "regulation of such buildings."

One of the chief complaints arising out of the past state of the law was that the coolies fouled a water-supply used by the Burmese, and it would appear that no provision of wholesome water is contemplated for coolie houses. It may be that such power can be exercised in conformity with local habits and customs; but it may be pointed out that in the model byelaws for common lodging-houses in this country the following express provision has been inserted:—

"The house should have a water-supply of good quality, and if the water be stored in cisterns "they should be conveniently placed of proper construction to prevent any fouling of water."

In a former Report about Rangoon it was stated that in a case where good water had been provided for the use of coolies they made use of bad water, because it was nearer at hand. It would hence appear that power to prevent the use of bad water might be advantageous.

1st April 1885.

No. 11.

MEMORANDUM of the ARMY SANITARY COMMISSION on the ADMINISTRATION of RAJPUTANA (SANITARY, VACCINATION, DISPENSARY, and JAIL) for 1883.

1. The sanitary statistics of Rajputana fall under two divisions, those for the British districts of Ajmere and Merwara, and those of the Native States.

2. The population of the former amounted in 1881 to 460,722, and that of the Native States to 9,354,163, making together 9,814,855 as the population of Rajputana. But as the statistics are obtained through separate agencies, we shall deal with them under different heads, beginning with the British districts.

3. The births in Ajmere and Merwara in 1883 were, of—

Males	6,633
Females	5,581
Total	12,214

equal to a rate of 26·51 per 1,000; and for every 100 female births there were born 118·84 males.

4. Within the same area there died, of—

Males	4,170
Females	3,419
Total	7,589

equal to a death-rate of 16·47 per 1,000 of the population, and for every 100 deaths of females 121·97 males died. It is evident that these figures are incorrect, otherwise, with a very low death-rate for India, the male population must be undergoing decrease in these provinces.

5. The error is probably confined to 1883, as the previous five years' average death-rate was 25·02 per 1,000, which is much nearer the true rate. The lowest rate of the year, 4·19 per 1,000, was returned from Ajmere suburbs, but the population is only 8,592. The highest rate, 28·99, was returned from Nasirabad town. In this case also there was only a small population of 21,320, but large enough to indicate bad health. Nasirabad rural circle registered a death-rate of 32·28 per 1,000.

6. The following abstract gives the death-causes in 1883 :—

Death Causes.	Total Registered Deaths.	Deaths per 1,000 of Population.
Cholera	87	·79
Small-pox	279	1·25
Fever	4,719	10·24
Bowel complaints	324	1·79
Injuries	261	·57
All other causes	1,119	2·43
All causes	7,589	16·47

As will be seen, cholera was the least fatal epidemic in the British districts. All the deaths took place in a single outburst of the disease, namely, 11 deaths in July, followed by 60 deaths in August, and then 16 deaths in September, with which the epidemic ceased. Fatal cases were returned from 9 out of 23 registration circles, and from 12 population groups out of 739 in the districts; 33 of the deaths were returned from the town of Ajmere, 17 from its suburbs, and 3 from its rural circle, hence 53 out of 87 deaths took place within a very limited area. Nasirabad town had 8 cholera deaths.

7. The following is the account of this epidemic given by the Medical Officer:—"No evidence "appeared showing reason for its onset." In the city those affected belonged to all classes residing "in the different mohullas. They had nothing in common except their residence within the same "area, and there was nothing to show that the disease was imported." This is the usual law of localization, in obedience to which, when cholera has swooped down on an area, every resident within it is liable to attack, whatever may be the nature of his domicile. Some people may yield only cases of diarrhœa, others non-fatal cases of cholera, and others fatal cases. The law appears to be that while cholera is present as an epidemic in a locality, its intensity rather than its presence simply is determined by the sanitary conditions under which the people live, and it follows that fatal cases of cholera may occur in houses where ordinary sanitary observation can discover no adequate cause. In some such cases the causes are strictly personal, as has been long known. Hence the practice of issuing advice in regard to diet, regimen, attention to the state of the bowels, and similar matters during cholera times.

We shall in the sequel give some information about cholera in the Native States.

8. *Small-pox and Vaccination.*—In the British districts small-pox was a much more formidable disease than cholera. It was fatal in 21 registration circles out of 23, and in 169 villages and towns out of 739. Three towns out of five in these districts yielded 53 deaths, and the country circles yielded 526 deaths. The town death-rate was ·50 per 1,000, the country rate 1·42 per 1,000, and the rate of the province 1·25 per 1,000.

9. The following were the monthly deaths registered:—

Months.	Small-pox Deaths.	Months.	Small-pox Deaths.
January	36	July	56
February	47	August	14
March	145	September	15
April	126	October	7
May	76	November	11
June	25	December	21

10. The vaccination service in Ajmere and Merwara, with their population of 460,722 was carried on by six vaccinators. We have seen that the births amounted to 12,234, which number may be taken to represent the available subjects of vaccination, but the actual successful vaccinations under one year of age were only 2,333, or a little under a sixth of the births. Between the ages of one and six years there were vaccinated 1,830 children, while the total successful vaccinations were 4,773. Of the 579 small-pox deaths, 208 took place in children under one year of age, and the whole mortality except 44 deaths fell on children under 12 years of age. It is thus obvious that vaccination requires to be very considerably extended at the younger ages.

11. *Fevers.*—Diseases classed as fevers gave rise to the following monthly deaths in 1883:—

Months.	Fever Deaths.	Months.	Fever Deaths.
January	432	July	352
February	441	August	461
March	440	September	394
April	381	October	362
May	352	November	368
June	376	December	430

The rainfall during the months January to May was 2·61 inches, against a previous six years' average of 1·70 inches. From June to September the fall was 14·52 inches, and the previous six years' average 21·86 inches. October to December yielded ·15 inches, against a previous average of 1·06 inches. The total rainfall in 1883 was 17·28 inches, or 7·34 inches below the average. The data appear to show that the higher rainfall from January to May was attended by a higher fever mortality, while the lower rate between June and September corresponded to a much lower fall. But apparently the low and variable temperature months also yielded the higher fever-rates.

12. Fever was universally prevalent. All the 23 registration circles yielded fever deaths in 1883, and 718 population centres out of 739 suffered. The country fever death-rate was 10·33 per 1,000, the town rate was 9·90 per 1,000, and the rate for the province 10·24 per 1,000. A much larger fever death-rate was returned from some circles than from others, but this is the only practical fact about local causes. One circle, Jasakhera, registered 4·54 per 1,000, which was the lowest, except the rate in the suburbs of Ajmere, which was 1·51 per 1,000, with which may be compared the rate of 17·37 for Pokher circle, proving the influence of locality on fever. There is one hopeful fact, however, and this is the reduction of fever mortality in all the circles below the average. The total fever-rate of 1883 was 10·24 per 1,000, while the preceding five years' average had been 15·88 per 1,000. No account is given of the local conditions under which these various rates have occurred, but the facts would point to differences in sanitary condition.

13. The other death causes in these British districts do not appear to call for remark.

14. *Sanitation.*—Under this head it is stated, that "all the vaccinators have been instructed in the "contents of the Sanitary Primer, and desired to do their utmost in spreading this knowledge "amongst the villagers."

As regards Ajmere itself, it does not appear that much progress has been made with its sanitary works, and the Medical Officer tells us that it "leaves much to be desired from a sanitary point of "view."

15. *Native States.*—Registration of births and deaths in the Native States is carried out by the Native authorities. It is still in a tentative condition, but we are glad to receive such data as can be given, in the hope that before long the results may approach those obtained in the British districts. Returns of births were made in 1883 from Bhurtpore and Jhalrapatan cities, and from Bhurtpore and Jhallawar States. The two cities registered respectively 21·28 and 23·54 per 1,000 births, and the two States 4·83 and 10·65 per 1,000. The facts only show that registration work has been commenced.

16. Deaths were returned from all the registering cities and States. The following abstract, showing the distribution of death causes, may be here introduced to show the present state of the registration. It is, of course, imperfect, but it is creditable to the Native authorities who have supplied the data :—

Native States. Name.	Population, 1881.	Cholera.	Smallpox.	Fevers.	Bowel Diseases.	Injuries.	Deaths, all Causes.	Ratio per 1,000 of Population.
Jeypore (city)	142,587	348	14	1,801	—	—	4,184	29·34
Bhurtpore ,,	66,163	21	—	99	—	1	1,461	22·06
Ulwar ,,	49,867	5	12	396	13	—	910	18·24
Oodepore ,,	35,274	—	5	929	56	16	1,270	35·25
Jhalrapatam (city)	11,469	—	13	85	116	12	237	20·66
Bhurtpore States	645,340	26	90	658	30	8	2,932	4·66
Jhallawar ,,	340,488	77	163	1,285	751	134	2,826	8·29
Total	1,291,319	472	298	5,253	966	171	13,799	10·69

The chief death causes in these States are classed under the head of fevers. Smallpox was a secondary death cause in the Native States, and appears to have been of merely local prevalence. To cope with this disease there were 74 vaccinators, and the successful primary vaccinations of the year amounted to 107,628.

17. We are glad to learn that progress in sanitary work is being made, although much, of course, has to be done in this direction, as the statistics show.

In Jeypore frequent sanitary inspections were made and public latrines provided. Village sanitary rules were also circulated. In Oodeypore city cleansing was carried on.

Ulwar city is described as "probably the cleanest in Rajputana. . . . In the head-quarters of "each of the 12 tehsils more care is taken to secure cleanliness about the wells, and in the streets "and public places, and it is hoped that in time this example may have its effect on the people."

On the other hand it is stated that at Jhodpore "sanitation is much neglected. There are no public latrines, though a staff of sweepers is kept up."

18. Sanitary work, as we understand it, is new to these Native States, but, as the authorities have made a fair commencement with their sanitary statistics, we must hope that they will follow up this primary step by a more rapid advance in efficient sanitation on the lines laid down in our "Suggestions."

19. One satisfactory circumstance stated in the Report is the improved sanitary condition of the jails. There is one jail in Ajmere and 13 in the Native States. The average population of Ajmere jail was 562; the average daily sick was only 6, and the deaths 6, or 11 per 1,000 per annum.

20. The average population of the Native jails was 2,695; the average daily sick, 166; and the deaths 89, or 33 per 1,000. The Ajmere death-rate of 1883 was 15 per 1,000, under the rate of the previous year, and the rate in the Native jails showed a reduction of 3 per 1,000. The chief death causes in all the jails are respiratory diseases and diarrhœa and dysentery.

21. It is satisfactory to learn that "more care is being bestowed on the prisons throughout the "province, in many of which improvements are constantly being made." In the largest of the jails, that of Jeypore, "the water supply has been completed, drainage improved, and tubs supplied for bathing. "Excreta are now removed beyond the jail limits," and the dietary has been improved. At Jhodpore, where eight deaths were caused by dysentery, vegetables are scarce and dear, and mango preserve, with better clothing, are provided.

The new Kotah jail is stated to be "remarkably healthy." There was some overcrowding and tendency to scurvy in Jhallawar jail, but the buildings were being enlarged and anti-scorbutics issued to prisoners. The accommodation in Oodeypore jails is described as "wretched." Ulwar jail was found in excellent order; "sanitary arrangements very good, and clothing and food satis- "factory." In Bhurtpore jail the health of prisoners had improved. Vegetables were issued on alternate days, and cleanliness enforced. Similar remarks are made on Dholpur jail.

A new prison for Tonk was being built.

In conclusion, these are the principal sanitary data supplied by the Report under review. They do not call for special remark. Statistics and sanitary procedure are only of recent introduction in Rajputana, and it is satisfactory to find that both have been taken up by the authorities of Native States, and their results applied usefully. We can only advise that our "Suggestions" may be adopted, so far as they are applicable as a basis of work, and express a hope that future reports may show continuous improvement in the public health.

7th August 1885.

No. 12.

Memorandum of the Army Sanitary Commission on the Report of the Commission appointed under Section 28 of Act IV. (B.C.) of 1876, to inquire into certain matters connected with the Sanitation of the Town of Calcutta.

1. For a number of years past we have called attention to the fact that, notwithstanding the large extent of sanitary work carried out by the Municipal Commissioners of Calcutta in the matters of drainage and water-supply, the city death-rates, especially from diseases of the epidemic class, were still high, and that recently they had shown a tendency to increase.

2. From the detailed information supplied by the annual municipal reports, we were able to trace this unsatisfactory state of the public health past the existing main drainage and water-supply to the foul condition of bustees, wells, and water tanks, and to absence of adequate arrangements for cleansing and removal of domestic filth. It appeared to us as if too much dependence had been placed on the permanent works, to the neglect of those complete and continuous cleansing measures which could in no sense be dispensed with until the permanent works had arrived at such a degree of perfection in application that they could be trusted for doing the work of domestic cleansing, which in the meantime would have to be carried out by hand labour. Many years ago we laid down in one of our Memoranda on the Calcutta Works the leading principle that works of drainage were merely a means to an end, and that their main object was to enable healthy houses to be provided. About the same time, the projected waterworks were referred to us, and we had no difficulty in stating that they would not supply the amount of filtered water required for the daily wants of the population, and that the plans would have to be extended either then or subsequently at a large additional outlay. This unnecessary cost is now being incurred, because there must be a large addition to the water-supply before house and bustee drainage can be effected, and the present Report shows that drainage has been obstructed because of want of sufficient water for flushing drains and sewers. Indeed, for this latter purpose and for street watering a separate supply of unfiltered water has had to be raised from the river by pumping and distributed by a special set of pipes, which in their turn have been found to be too small to convey the required amount of water.

3. Again, the cleansing arrangements were shown by the same reports to be liable to intermitted action, that they were quite inadequate to the public necessities, and that they did not reach the interior of bustees or house compounds, where the real epidemic disease causes were to be found. It was not too much to say that while the municipality deserved great credit for the work they had done, there was no systematized sanitary department, complete in all its parts, and energetically directed from one centre, and as a result there were partial failures in these very departments where such failures were sure to be detected by increased mortality especially from epidemic diseases.

4. The facts had become so well known in Calcutta that public opinion was roused, and the Government of Bengal, in the exercise of a power conferred on it by statute, appointed a Commission of Inquiry, chiefly to report on the state of cleansing, but the Commission soon discovered that they would have to inquire into other matters as well. They inspected many of the bad districts, and took evidence from witnesses. They have embodied the results in the present Report, which contains an exhaustive account of the condition of the capital of India at the present time, and it is not too much to say of this Report and the papers accompanying it, including the proceedings of the Supreme Government and of the Government of Bengal, that, whether for the facts they set forth or for the sanitary administrative principles which they enunciate, they must take rank among the most important contributions to Indian sanitary improvements.

5. The Report itself, which is signed by two of the Commissioners, Mr. Beverley and Dr. Lidderdale, Sanitary Commissioners for Bengal, gives a full digest of the results of the inquiry. They have localized the facts in a way that had not hitherto been possible, although they may not have added much to the validity of the general conclusions hitherto arrived at, and they have shown beyond any doubt that the local causes of the epidemic death-rates have been only very partially reached by the permanent works, and that, so far as epidemics are concerned, drainage extensions to house drainage, drainage improvements generally, and extension of the water-supply are absolutely necessary for the progressive improvement of the city, but that while these are incomplete there are other measures which are of immediate necessity, and which ought to be proceeded with at once.

6. We may here notice very briefly the dissent of Mr. Cotton from the conclusions of the Report. These are mainly grounded on work which has been already done, and on some differences of estimate on the value of the facts. The reply to this is simply that all parties, the Supreme Government, the Government of Bengal, the complainants, the Commissioners in the present inquiry, have done as we have done all along, namely, all have fully acknowledged the value of the work which the Municipal Commissioners have accomplished. This work and its results to the public health are not in question. The complaints refer to work which has been left undone, or only partially done.

7. Leaving out small points of detail, we cannot summarize the sanitary requirements of Calcutta more briefly than has been done by the Supreme Government in the present proceedings. They say: "It was long ago pointed out by the Army Sanitary Commission that the best and only practi-"cable way of reducing mortality and minimising the effect of epidemics in Calcutta is to provide

" the people with pure water to drink, to complete the drainage system and house connections, to fill " up all foul tanks and wells, to level and drain the surface soil, to cleanse and keep clean the city, " not merely as regards its streets, but throughout its private premises and courts, and to reform " radically the bustees and their water-supply." These are all apparently separate items, but in sanitary administration they are one whole, because they are so dovetailed into each other that any defect in the continuity of work may increase the death-rates, and this is just what has happened.

8. Again, municipal Calcutta has outside its present boundary extensive suburbs, and Mr. Cotton not unnaturally points to the higher death-rates of this large population of 250,000 as a proof of great advance in the public health within municipal limits. This is quite true, and is part of the acknowledgment due to the Corporation for its work. But the deduction from it is not that Calcutta has done all that is needful or to justify any delay, but that the suburbs should be incorporated with the town as soon as possible, and the whole brought under one active united sanitary administration, beginning with registration of births and deaths, and including water-supply, drainage, continuous cleansing, and all the other points of sanitary improvement. We are glad to see that this important matter has been taken in hand, and that there is a prospect of the greater part of the vast population of city and suburbs being placed under one consolidated administration at no distant date. The two areas are so connected that even now it is scarcely possible to ascertain what the death-rate of either area amounts to, and even if municipal Calcutta were entirely freed from localizing causes of epidemics, it would by no means follow that the public health would be safe from disease causes left to develope epidemics in the immediate vicinity of the improved area.

9. We have endeavoured to confine our remarks on these papers to the general sanitary principles involved in the discussion, because this Calcutta experience may be said to include points which have arisen elsewhere in India. So far as the special Calcutta incidents are concerned, these have been so fully dealt with in the Report and in the proceedings of the Supreme and Bengal Governments that it is quite unnecessary to enter on them.

10. But besides the special sanitary principles involved there are other two matters of importance in regard to which we are desirous of expressing our entire concurrence in the views put forward by both Governments.

If in India or anywhere else there happens to exist any form of local government charged with sanitary duties for the protection of the citizens, and if it is found by experience that the death-rate, especially from epidemics, does not diminish, but increase, which is the surest test of public obligation imperfectly discharged, neither in India nor anywhere else can the local authority set up the plea of local self-government as any excuse whatever for averting public interference, for the very obvious reason that it has been placed there to prevent the necessity of public interference or complaint.

11. Again, as the need of more active sanitary work has been demonstrated by the Report of the Commission beyond the possibility of doubt, it is obvious that a more liberal expenditure, or a better directed expenditure, will have to be incurred. This additional outlay may, to some extent, be met by vesting all the town sewage in the municipal authorities, and by making it one of the elements of cleansing that this manure should be systematically removed and sold to cultivators. The foul cattle sheds should be dealt with in a similar way. It may be suggested whether the experience of Bombay with its public cattle stalls might not be consulted in this matter. Any way the Calcutta municipal authorities must recognise that of all the unprofitable directions in which public money may be saved, the most unprofitable is that in which the saving is represented by high epidemic death-rates, which represent not only loss of life at the periods when life is of most value to the State, but loss of working power, which destroys the very elements of wealth.

12. It is unnecessary to say more than to express our general concurrence from the side of sanitary improvement with the views of the Supreme Government and the Government of Bengal in these papers, which we hope may have their influence on other local bodies in India besides the Calcutta municipality, and we cannot do better than conclude this Memorandum with the following words:—

" The Governor General in Council trusts that, for the future, the public spirit of the Commis- " sioners will lead them fully to recognise these facts, and that their action will place it out of the " power of any outside critics to impute to them indifference or failure to justify the confidence of " Government in entrusting to their hands the municipal arrangements of the metropolis of British " India. The good effects which have undoubtedly resulted from what has already been done " should encourage the Corporation to organise its operations upon a larger scale, and induce the " community generally to bear cheerfully the heavy burden which the urgency of the reforms " required plainly imposes on it. If in any respect the present law fails to give the Corporation " adequate control over nuisances arising from the action or inaction of individuals, the local " legislature should be moved to amend it."

Backed by such recognition and support, it is to be hoped that, in the words of one of our former Memoranda, quoted by Mr. Cotton, "a glance at the results already attained ought to be the strongest " inducement to perseverance until the capital of India is finally cleansed of its local disease " causes."

19th October 1885.

No. 13.

Memorandum of the Army Sanitary Commission on the Administration Report of Madras Municipality for 1883.

This Report contains the usual details of the Municipal income and expenditure. It is not a sanitary report properly so called, and any information on the subject is mostly limited to statistical data, from which we shall endeavour, as far as practicable, to arrive at some estimate of the year's sanitary history.

1. By adding together the numbers for each of the eight divisions of Madras, the aggregate population amounts to 398,777.

2. Including still-births, the births registered in 1883 were :—

Males	8,447
Females	8,017
Total	16,464

which gives a birth-rate of 41·2 per 1,000, showing that in all probability the population element is under estimated. In one division, indeed, the ratio of births is given as 48·7 per 1,000. Of the births, 1,218 were registered among Christians, 13,364 as Hindus, and 1,882 as Mahomedans.

3. *Deaths.*—The deaths registered in 1883 were :—

Males	7,975
Females	7,907
Total	15,882

or 39·8 per 1,000.

If the population is under estimated, this ratio would be too high. Still, the figures show an increase of 1·4 per 1,000 on the population of the year over the loss by deaths. Of the deaths, 79 were registered among Europeans, 342 among East Indians, 534 among Native Christians, 13,153 among Hindus, and 1,774 among Mohamedans.

4. The year 1883 yielded the highest number of registered deaths since 1872, excepting, of course, the pestilential mortality which accompanied and followed the great famine of 1877. Leaving out the famine, the average deaths registered were 15,059·3 per annum, while, in 1883, the registered deaths were 15,882, showing a rate, above the average, of 822·7 deaths.

5. *Causes of Death.*—The following abstract gives the registered deaths from each assigned cause in 1883, compared with the previous 10 years' average, excluding the famine year :—

Causes of Death.	1883.	Previous Ten Years' Average.
Small-pox	4,957	733·5
Measles	138	69·0
Fevers	3,470	3,229·2
Bowel complaints	2,284	2,327·9
Cholera	169	376·0
Total all causes	15,882	15,059·3

The rise in the death-rates in 1883 was on the side of small-pox, measles, and fever, while mortality from bowel diseases, including cholera, had diminished; but the mortality from diseases of the epidemic class was above 50 per cent. of the mortality from all causes, viz., 8,018 epidemic deaths out of 15,882, while the 10 years' average was 6,730 deaths out of 15,059. We may here remark, in passing, that one main object of all sanitary works and measures is to reduce this proportion of epidemic deaths; and where there is a tendency to increase in the proportion it is a sure sign that there is something requiring remedy. Another similar remark may be made regarding the proportion of deaths under five years of age, which was no less than 51·96 per cent. of the mortality of all ages. No better test of the real sanitary condition of dwellings and their surroundings can be had than this ratio affords.

6. Madras consists essentially of an aggregation of villages, 36 in number. Their average death-rate in 1883 was 37·9 per 1,000. But this rate varied in each of the eight groups into which these villages are divided. The lowest ratio was 20·6 per 1,000 in No. 6 division. The highest ratio, 42·7 per 1,000, was returned from No. 3 division, which contains 52,443 inhabitants in three villages. In one of these three villages there were 417 deaths from small-pox, 25 from measles, and 441 from fever, besides 208 deaths from diarrhœa and dysentery, but there were only two deaths from cholera, showing that, among a population whose epidemic deaths, apart from cholera, were no fewer than 1,091 out of a total mortality of 2,236, the deaths from cholera bore no relation to the epidemic susceptibility of the inhabitants. Cholera was, in fact, a superadded disease, not necessarily related to the year's epidemic history of the locality.

7. The other village groups afford similar illustrations of the fact that, although cholera swoops down on unhealthy localities from time to time, and causes great loss of life, this loss is, nevertheless, a small affair, when compared with the silent, almost unobserved, havoc occasioned by ordinary epidemics in localities where their predisposing causes are continually present. The practical lesson, as regards Madras, is one which has been often enforced, and this is, that the only key to sanitary expenditure and work is afforded by these village statistics, and that those which show the largest loss should be first taken in hand for improvement.

In the next abstract we shall place, side by side, the monthly deaths from epidemics in all the villages:—

Months.	Total Deaths,				
	Small-pox.	Measles.	Fevers.	Dysentery and Diarrhœa.	Cholera.
January	35	10	312	183	—
February	68	10	306	152	—
March	132	9	273	149	1
April	124	10	245	102	—
May	113	6	275	147	—
June	127	13	238	144	—
July	185	12	290	169	1
August	165	14	391	333	—
September	127	9	316	230	2
October	180	9	250	184	11
November	180	11	245	201	68
December	526	25	329	290	86
Total	1,957	138	3,470	2,284	169
Ratio per 1,000 of population	4·9	·3	8·7	5·7	·4

This table shows an augmented death-rate from these epidemic diseases towards the end of the year, and two of them, small-pox and cholera, present the appearance of epidemics in progress and passing over to the year 1884.

Following on this general statement of the epidemic history of 1883, and, in the absence of any information in the present Report on the sanitary condition of affected localities, we shall introduce a few remarks on the sanitary agencies employed for coping with the diseases, beginning with small-pox, which, as we have seen, gave rise to 1,957 deaths.

In 1883 there were 16,069 children born alive, as the subjects alike of small-pox and vaccination. Out of this number of births there were, as corresponding with them, 13,789 successful vaccinations under one year of age, so that these fell short of the births by only 2,280. The successful vaccinations under six years of age were 14,769, and for all ages there were vaccinated successfully 37,138 individuals.

10. The vaccination staff consisted of one Deputy Inspector, 20 vaccinators, and three peons. The percentage of vaccinations to the total population was 10·27, which, no doubt, is a high average; but the deaths from small-pox in 1883 amounted, nevertheless, to 4·9 per 1,000, which is also a very high average. If the ages of small-pox deaths were placed alongside the vaccinations, we should be able to arrive at a better estimate of its value in saving life. All we know is that, while 88·2 per cent. of the births are represented by the proportion of vaccinations, there was a high death-rate from small-pox.

11. Practically, therefore, we must revert to the influence of locality in predisposing people to epidemics, and, amongst others, to epidemics of small-pox, and insist anew on the necessity of improving these Madras villages in all their conditions. But, on this very important matter, there is not much information in this Report.

12. One of the most important works was the completion of drains for diverting the sewage from the Coonm. Eleven and three-quarter miles of surface drains were completed, 314 new house drains (nature not stated) were constructed by owners, and 21 by the Municipality. The backyards of several houses were raised. The cost of drainage for the year was 16,435*l*. We are not in a position to give any opinion on these drainage works. On former occasions we have stated our views fully on facts laid before us by the authorities of Madras, on which we laid down the general principles that the drainage of any town or place involves in it the freeing of the subsoil from sewage and preventing any subsequent infiltration into it.

13. One hopeful feature in the drainage operations is the extension of sewage farming. There are eight farms in operation and a new one has been formed. The receipts on the first eight were Rs. 13,493. 9. 0, and the outlay Rs. 13,014. 7. 9, showing a net profit of Rs. 478. 10. 0. But the actual profit on four of the farms was Rs. 2,251. 7. 9, from which, however, in the general account had to be deducted R. 1,772. 13. 9, which was the loss on the other four. Let us hope that these four may soon return similar profits to the others, and then there would be cause of satisfaction; by another successful application of sewage to agriculture in a locality were manure and moisture are both required.

14. The water supply extension works had also made progress, as is shown by the expenditure of 16,543*l.* during the year. Forty-five miles of pipes had been laid; 311 fountains were in use, together with 674 hydrants.

The quantity of water drawn in 1883 amounted to 137,414,502 cubic feet. With the present reservoir and the rainfall of 55·09 inches, the engineer says, "the supply may now be considered "available to 375,000 people, so that the amount per head per day is 6·4 gallons." As soon as the distribution is completed, all the bad wells should be once for all abolished.

15. The analysis of one out of several water samples drawn from a tap in Royapuram will show the quality of water:—

	Grains per Gallon.
Total solids	15·40
Volatile „	7·00
Chloride	1·96
Free ammonia	·224
Albumenoid ammonia	·168
Nitric acid as ammonia	·84
Total hardness, Clark's scale	3·3°
Permanent „ „	2·1°

This analysis may be taken to represent water from a country surface affording little soluble non-organic material, but a large amount of vegetable organic compounds not necessarily injurious to health, but admitting of reduction by aeration and filtering, which appears to be the result of this analysis

16. *Conservancy.*—This has hitherto been the best part of Madras sanitary administration, and employs a very large staff. In the work of cleansing there were engaged 1,037 men, women, boys, and girls, with the following material:—

Bullock pairs	373
„ single	16
Drivers	389
Carts, contractors' and municipal	420

On house conservancy there were employed 91 bullocks, 60 drivers, 12 coolies, and 272 carts of one kind or another. The hire was, for,—

	R.	A.	P.
Carts	8,527	13	7
Bullocks and drivers	92,208	6	4
Scavengers	66,714	13	8

And the amount of work done was as follows:—

Rubbish cartloads	214,279
Silt „	149,049
Night-soil service,—	
Latrine carts	14,151
Buckets	98,556
Iron carts	17,042

The last three heads include the cleansing work continuously done by sewers and drains in a drained town, where all the sewage matter of a population is removed at once, and as soon as it is produced, to a safe distance, and the subsoil protected from infiltration. Every hour's delay in a warm climate is an hour of danger to the public health, and, notwithstanding the large sums devoted to house cleansing in Madras, London, with about ten times the population, enjoys the immense advantage of being entirely cleansed from sewage within two or three hours of its production.

17. Besides the usual sanitary measures, there were roads made and reformed, and public parks and fountains attended to or provided. And hence, if we were to accept as the best possible the general scheme of sanitary improvement which has been acted on by the municipal authorities, we should have to admit, as a matter of course, that good public health work was being done in the direction which has been chosen. But when we come to apply the epidemic test to a large city on the sea-board, where there ought to be free play of pure air, and little epidemic disease, the statistics at once tell us that there is something wrong. And this is in all probability wet foul subsoil. We are aware that old facts on this point reported by former municipal officers have lately been denied, but since then, as we have noticed in our Memorandum on the Report of the Sanitary Commissioner of Madras for 1882, facts of a similar character have been again reported, and it may be taken for granted that, to the extent to which the subsoil water-level approaches the ground surface of a densely peopled, foul, undrained area, will the susceptibility to epidemic diseases prevail.

18. As the municipal authorities have made their selection, after full discussion, of a scheme of procedure, all we deem it necessary to do is to express a strong opinion that the main reliance in future for protecting health must be placed on perfecting and maintaining the cleansing system, including under this head levelling and improving surfaces, filling up holes, and removing animals from the houses and house compounds in the villages. But when all is done in this direction, there will still remain a large susceptibility to epidemics among the population.

6th August 1883.

No. 14.

Memorandum of the Army Sanitary Commission on the Administration Report of the Municipal Commissioner of Bombay for 1883–84.

1. This Report raises a few questions of a somewhat different kind from those we have dealt with in previous memoranda.

We have here a large city, with a calculated population since the census of 1881 of 807,905, shewing an increase over the census number of 24,709, which has for many years had a water-supply brought from a distance, which has discussed and re-discussed a proposed system of main sewerage and drainage, which, moreover, has spent large annual sums for conservancy, and maintains a large staff for the work, and nevertheless its water-supply is insufficient; its sewerage and drainage, so far as cleansing is concerned, are, to say the least of it, quite inadequate to its wants, and we have the testimony of Mr. Hewlett, the Sanitary Commissioner for Bombay, that, as regards cleansing, this great city remains an "Augean stable." It is true that a city nearly surrounded by the sea has many countervailing advantages in ventilation and in the neutralizing of foul air over an inland city, such, for example, as London, and yet the British metropolis, with a nearly fivefold population, could show a death-rate in 1883 of 20·40 per 1,000, while the rate for Bombay was 29·12 per 1,000. Both cities, moreover, have executive authorities, and it seems not unjustifiable to call the attention of those in Bombay to this very striking contrast, in order that they themselves may discover the causes and apply the remedies.

2. In former memoranda we have admitted the importance of sanitary work done in Bombay, as proved by the lower epidemic rates of years since the work was commenced. We have also adduced the diminishing annual mortality as a proof that the measures which had been in progress were being attended with beneficial results to the public health, and we shall here reproduce the figures, with the addition of those for 1883:—

Years.	Total Deaths.
1877	35,511
1878	26,999
1879	22,527
1880	21,146
1881	21,856
1882	20,468
1883	23,530

It will be seen that, apart from any question of ratios, which are dependent for their accuracy on our knowledge of the population, the continuous reduction in the number of deaths received a sudden check in 1883 by the addition of above 3,000 deaths to the registers. Having stated what was the sanitary problem for 1883, we shall next proceed to discuss the contents of the Report which bear on it.

3. The population of Bombay at the period of the census of 1881 was 773,196. The higher number we have already given is an estimated increase, but we have no proper reason for accepting the assumed law of increase. It has not been proved to be real, and if it be too high it must necessarily lower the death-rate, and so far lead to an incorrect estimate of the real state of the public health.

4. Exclusive of still-born, there were 15,182 living births registered in 1883. There were 1,449 still-born. The birth-rate on the calculated population was 18·79 per 1,000, against about 34 per 1,000 for London, showing a large under registration of births in Bombay.

The registered deaths, exclusive of still-born, were 23,530. On the census of 1881, this registered number would yield a death-rate of 30·43 per 1,000 which is probably nearer the true ratio than 29·8 which would result from assuming the calculated population as a basis.

We should probably be safe in assuming 30 per 1,000 as the true death-rate of 1883, or 4·11 above the ratio of 1882.

6. The following were the assigned death causes, but the ratios are calculated on the assumed increased population, and would probably require a seventh to be added as a correction:—

Diseases.	Number of Deaths, 1883.	Ratios per 1,000 of Population, 1883.	Deaths, 1882.
Small-pox	1,461	1·81	92
Measles	319	·39	991
Fever	5,903	7·31	5,453
Cholera	1,627	1·97	193
Phthisis	3,144	3·89	2,729
Nervous system	2,649	3·53	2,557
Respiratory ditto	3,394	4·20	3,402
Diarrhœa	1,160	1·43	1,003
Dysentery	646	·80	525
Accidents	357	·44	346
All other causes, except still-born	3,270	4·05	3,038
Total	23,530	29·12	20,468

In this table we have added the deaths for 1882, in order to see where the increased mortality in 1883 has taken place. It will be observed that the year's increase amounts to 3,062 deaths. Of this increase 1,369 were due to small-pox, 835 to cholera, 450 to fevers, 88 to diarrhœa and dysentery. The total increase of epidemic deaths, all known to be more or less influenced by local conditions, was 2,742 out of the total year's increase of 3,062 deaths. But there is one epidemic not necessarily connected with local conditions, namely, measles, which showed a large decrease in 1883. Respiratory diseases yielded nearly the same mortality in both years. Phthisis was more fatal in 1883, and this disease is dependent, so far as concerns locality, mainly on overcrowding of population and on the state of the air movement. The increase of diseases of the nervous system depends on another set of causes. We thus arrive at the conclusion that there was a large increase of susceptibility to epidemics dependent on local causes, and that to these the augmented mortality of 1883 was mainly due.

7. The first disease in the list, namely, small-pox, which yielded an increase of 1,369 deaths, or nearly sixteenfold the previous year's death-rate, had assumed an epidemic state in nearly all the districts of the city, and yet Bombay has an effective vaccination service, with the use of calf lymph.

We have already seen that the registered living births in 1883 were 15,182. The successful vaccinations in the same year were as follows:—

Under 1 year - - -	13,355
1 and under 6 years - - -	3,339
Above 6 years - - -	982
Total successful - -	17,676

We thus learn that in 1883 the successful vaccinations under one year nearly covered the births, and nevertheless the deaths from small-pox at ages under one year were 567, or nearly 39 per cent. of the total small-pox mortality; and 991 deaths, or 67 per cent. of the total small-pox mortality took place in children of ages under five. Unless we knew the number of deaths among the vaccinated, we could not state positively that vaccination had failed to this extent; but this efficient Bombay system has been in force for years, and is now compulsory. How, then, are we to account for these results? But there is nothing really singular in them, except the extent to which successful infantile vaccination has been carried on for years in Bombay. Everywhere while vaccination has been a constant quantity, small-pox has notwithstanding been liable to similar epidemic outbursts. It is a pure epidemic disease as well as a disease that may be modified by vaccination, and there is plenty of experience to show that this epidemic character must be met by diminishing the epidemic susceptibility of the people by ordinary sanitary methods.

Bombay cannot, any more than any other city, keep its population free of small-pox by vaccinating its people and leaving their surroundings without effective sanitary improvement, of the need of which this epidemic outburst is the touchstone.

8. *Cholera.*—In 1881 there were 546 deaths from cholera in the city. This number had fallen to 192 in 1882. But in 1883 no fewer than 1,027 cholera deaths were registered. There was a similar outburst of cholera in 1877 and 1878, after 11 years of diminution. This is the usual experience of cholera, and one of the objects aimed at by sanitary work is to break up this chain of sequence by improving the public health during periods of epidemic quiescence.

9. In former memoranda we have shown the very remarkable reduction which has taken place in the annual mortality from cholera since Bombay was placed under sanitary authorities. We have given the statistics for 34 years, the last 17 years of which, under the influence of public health work, lost one third only from cholera of the first 17 years before improvements were taken in hand. In 1874 there were only 19 deaths from cholera; in 1880 there were 30; and, as we have seen, there was a sudden rise to 1,027 deaths in 1883. It does not follow from the statistical facts that sanitary work is less efficient. It may indeed be taken for granted that the condition of the city in this matter was much the same as it was in 1874 when 19 people only died. In 1883 the epidemic prevailed with greater intensity, and it follows that the sanitary measures were insufficient to cope with the year's epidemic force, and no city in which such a mortality from cholera could occur can be considered as otherwise than unsafe.

10. We have besides the independent testimony of Drs. Klein and Gibbes, in their report on cholera, setting forth what they themselves saw in certain cholera localities in Bombay. Referring to two of these localities, Dobie Talao and Cavel, they say that "in both there was an attempt at "drainage; but, owing to the habits of the people of using the street gutters instead, any attempt "of collecting and guarding human excreta must be futile. Not only is this the case, but the excreta "in some streets (owing to the heavy rains) find their way from the waterclosets at the back of the "houses into the streets, and here the liquid sewage can be seen and smelt spreading in the gutters "and all around them. In addition to this there are wells situated in the street, or in some "instances, *e.g.*, in Dobie Talao, at the back of the houses. In both instances the passage of the "liquid sewage into the wells through the defective masonry can be detected without any difficulty. ". . . . The sanitary conditions existing in other parts of the town, and particularly in the "villages, are simply described by the word *nil*." Nevertheless there is evidence that in many parts of Bombay things have been greatly improved since the cholera deaths, with a much smaller population, amounted to 4,000, 5,000, and upwards in a single year.

11. These gentlemen have merely described for us typical cholera localities in a city over whose population cholera is always hovering. We have not yet ascertained how such conditions act,

whether by a specific poison or by the agency of cholera bacilli. All we know is that in such places there are two or three people who will die of cholera without the disease spreading to others in the same house or even in the same room, and the aggregate of such cases marks the epidemic intensity of a particular month or year. All are exposed to precisely similar conditions. All drink similar water, and its comma bacilli, if such happen to be present, have the opportunity of generating the poison of cholera in all of them, and yet, for some reason or other, only a very small minority suffer, proving beyond the possibility of doubt that some other condition besides any of these is required for the development of the phenomena to which we apply the name of cholera. Of one thing, however, we are certain, and this is that, if the local conditions described in the report we have cited be removed, the number of deaths from cholera will diminish or disappear. This is the very work for the doing of which a municipal government exists, and, so far as concerns the presumed "futile" character of attempts at improvement, all that need be said is that sanitary engineering knows nothing of such a word. Not many years ago there were cholera districts in London, Liverpool, and many other English towns of a similar kind, but all have long since disappeared under the operation of ordinary engineering works. It appears to us that this is precisely one of those cases in which an account should be taken of the work which has been done and left undone for the last 20 years, with the view of fixing the responsibilities of these neglects on their authors, and adopting the necessary measures for putting an end to them.

12. We have quoted the facts from the report of Drs. Klein and Gibbes, because they were directed by the Secretary of State to follow up the enquiry of Dr. Koch, and are hence of an independent character, and we shall now see what the Officer of Health of Bombay has to say on the subject.

13. He received notice of 1,474 cases of cholera of a very deadly character, inasmuch as 1,027, or above two thirds, ended in death.

These deaths, month by month, were as follow :—

Months.	Deaths from Cholera.	Months.	Deaths from Cholera.
January	2	July	236
February	1	August	433
March	4	September	152
April	15	October	26
May	84	November	4
June	36	December	37

The data are of importance, because they show that Bombay was visited by a distinct epidemic, which was apparently coming to an end in November after having caused 900 deaths.

In December, however, there were six deaths up to the 18th day of the month, when the Vehar water main broke and deprived the city of water for three days, compelling the people to use wel water and tank water for the time. This accidental circumstance was attended by an addition of 30 deaths to the year's mortality. Cholera being present as an epidemic, it is no doubt probable that some of the 30 deaths may have been due to this forced use of bad water, but there was an epidemic at the same time, as the table shows.

14. In dealing with facts of this nature it is always necessary to apply corrections, and these in the present case are as follow. The Vehar and Tulsi water is brought into the city by water mains, and is a comparatively pure water. The well waters are of the usual type, and the liability to attacks in persons using each class of waters stood thus in 1883 :—

Waters used.	Cholera Attacks.	Cholera Deaths.
Vehar and Tulsi	1,176	828
Well waters	198	142
Not known	100	57

The Vehar and Tulsi supply is intermittent and not sufficient, and it is alleged that to these circumstances, and the consequent use of well waters, some of the mortality may have been due. But the same facts have been repeated year after year, and they clearly show that the pipe water, whether totally or partially used, affords no protection against cholera. But the facts also lead to the conclusion that some other causes for the localization of cholera existed, and these were of the following kind :—

The Officer of Health says :—"On and in the neighbourhood of Navroji Hill, where sanitation was "in the very worst state for this city, and the water-supply least, cholera was most prevalent. The "gullies, drains, cesspools, and general surroundings of the houses were in a bad condition. Many "of the dwellings in which this disease broke out were badly ventilated, badly drained, and "dangerously overcrowded, while imperfectly constructed, and uncleaned cesspools were to be found "in various quarters. Near one house in C ward, where five cases occurred, the condition of the "cesspools was truly appalling. They are so large, and so constantly filled with a dilute solution of "sewage that we, with our inadequate establishment, were unable to keep them clean. . . . . "In Wardi also, the principle ostensible factors in the production of this disease were humidity of "soil and an absence of a pure water-supply, so frequently, indeed almost constantly, are these two

" factors associated with outbreaks of cholera, that it is impossible to avoid arriving at the conclusion " that they are the two principal causes of the conveying (?) the disease."

Mazagon district yielded a cholera death-rate of 2·97 per 1,000 of its population, and of this locality the Officer of Health states that while its better water-supply is liable to interruption "the wells are " liable to be constantly contaminated by percolation from adjoining cesspools, of which there are 174 " in this small section, the contents of which saturate the ground, giving rise to that humidity of the " soil which, combined with impure water, is almost universally associated with cholera."

Parel, with its cholera death-rate of 2·74 per 1,000, and Mahum, which yielded the highest cholera death-rate of the year, viz., 3·63 per 1,000, are in a similar sanitary condition, but in all the cases cited it will be observed that the "subsoil damp" ought to have had its proper name of "sewage infiltration" applied to it, which covers the whole case, and this may be summed up in a few words. These districts, which were the special seats of cholera in 1883, are densely peopled, badly supplied with water, undrained; the sewage passed into the subsoil as the only present means after 20 years discussion about sewers, not of getting rid of it, but of hiding it from view, where it festers and [redacted] air, earth, and water, and when cholera comes the people die.

[redacted] we wonder that European boards of health, with such facts at hand, should insist on [redacted] great commerce of India to quarantine proceedings? or rather, considering the [redacted] sts at stake ought we not to wonder that those whose commerce is thus made liable to [redacted] never cholera increases should submit to the continuance of such a state of their city [redacted]

The [redacted] has long been known, and all that is wanted now is to do the work, which is as much an [redacted] a local affair.

16. *Fever* [redacted] ses so classed were the most numerous death-causes in 1883. As already stated, the registered [redacted] aths numbered 5,903, or 7·31 per 1,000 of the population; of these deaths, 4,439 were reg[redacted] from remittants, 1,169 as from simple continued fever, 275 from ague, and 20 deaths from en[redacted] ver.

17. The *fever de*[redacted] e varied *greatly in different sections* of the city. The lowest rate, 1·04 per 1,000, was returned [redacted] he water division, and the highest, 13·09 per 1,000, from Parel. The *fever death-rate had b*[redacted] lling below the rate of previous years, but in the epidemic year 1883 it *rose like the rates from* cholera and small-pox, and 450 more deaths were registered during that year. The great prevalence of fatal remittent fever points to the existence of adequate local causes, no doubt of the same character as those present in cholera localities. At all events it is not necessary for practical purposes to endeavour to separate the causes. Cholera and fever will both decline in fatality as real sanitary measures and works are carried out in the districts where they prevail.

18. The only other diseases requiring notice are *phthisis pulmonalis* and *respiratory diseases*, from which the mortality in Bombay is very large. Deaths attributed to phthisis numbered 3,144, and to respiratory diseases 3,394. The former are, to a large extent, connected with the densely peopled condition of districts and dwelling-houses. Like other death-rates, those from consumption vary in different localities. The highest local rate of 1883 was registered in Nal Bazaar (Khara Talao). It was no less than 8·67 per 1,000. The remedy for existing evils under this head is opening up localities to admit a free circulation of external air, ventilating the houses, and spreading the population over a sufficient area. It has been long known that other things being equal the mortality from consumption bears a striking relation to the density of population in city districts, and this fact shows that town improvements are necessary in Bombay in addition to drainage, better water-supply, and more active cleansing operations.

19. In the preceding paragraph we have stated the main facts of the disease history of 1883, and we have dealt with the disease causes, as these are described in the same year's Report. After the loss of so much time it was our duty to make the remarks we have made because no future activity can repair the evils already past, although these might have been to a great extent prevented if earlier action in regard to them had been taken. We have never denied that good and necessary work had been done, and that life had been saved thereby, but, in the face of the facts already cited, it can scarcely be said that the present sanitary state of Bombay represents what ought to have been the aspect of epidemic localities after 20 years of sanitary work and expenditure. We shall here leave this point, and conclude our present remarks with a brief abstract of the present state of sanitary works and measures as given in the Report under review.

20. *Drainage and sewerage.*—The arrangements for raising and discharging the sewage at Love Grove were completed and in successful operation early in March 1884. At the date of the present Report the first portion of the new sewerage works, with the necessary manholes and lampholes, had been completed. The sewers appear to have been chiefly pipes, which were found on examination to be all clear. Specifications and contracts had been prepared for the house connexions of the first portion of the new sewerage works, and tenders were invited, but were found not to be satisfactory, so that this all-important sanitary work was still to be taken in hand. The Queen's Road intercepting sewer, by which the nuisance from sewage discharged into Back Bay was to be prevented, could not be completed on account of the heavy rains which stopped the work. The Clerk Road branch of the main sewer with adjacent pipe sewers had been completed. The Kamathipura sewerage works had been virtually completed, but had not at the time been connected with the new sewer. Part of the difficulty in this case had arisen from the obnoxious character of the work, and the disinclination of workmen to engage on it, who moreover preferred to remain idle. The surface drainage of this section had been taken in hand.

House connexion trial works for privies, outdoor sinks, and stables had continued to work satisfactorily. The ovoid sewers from Crawford market and across Byculla racecourse were under consideration, and also a scheme for providing pipe sewers in Agripada district. As part of the surface drainage scheme, the roads and compounds in Khetwadi had been raised and flooding prevented. A number of similar drainage works were in hand, including drainage of the Fort, and forming a flood water reservoir and other details.

21. It will be observed that all these works refer only to main drainage and main sewerage, and that up to the present time there is no evidence that progress has been made in removing the frightful condition of the houses. This is admitted by the Municipal Commissioner, who says in his report that, with the exception of the Kamathipura trial works, "all other house connexions work is in "abeyance, pending the further sanction of the corporation." And as regards difficulties connected with this provision in India he states as follows:—"The great object to achieve for the sanitary "improvement of the city is to carry off polluted water or house sullage by means of the new sewers "and to do this it is absolutely necessary that a mode of ingress inaccessible to storm water "other words above the ground level should be secured. Until this is done most of the ne "are practically useless, and the evils for which they were designed continue unabated." this condition of matters involves the contriving and execution of engineering works mountable difficulty, and the answer would appear to be a direct one, that if this state levels be the cause why sewage is passed into the subsoil to the destruction of h follows, the corporation should apply the remedy which the fact suggests. We have ed by the Report itself to trace the abominable state of the houses and the outbreak up to its source.

22. Before leaving this subject we shall quote the following passage fro missioner's Report, because it appears to point to certain local habits as standing in the w ise drainage improvements; he says:—"Provided there be an efficient system for the sp oval of night-"soil, it matters little (except from a financial point of view) whether the s 'wet' or 'dry.' "The latter is at present, at any rate, the more in accord with the customs as of the inhabi-"tants, but for the removal of sewage other than the night-soil, the duty of ling at once with a "complete system of sewerage cannot be too strongly insisted on." To e this statement it should have been shown by the municipal engineer why the same house d hich convey away the liquid sewage could not be so contrived as to remove an additional 200th p which constitutes about the proportion of solid. This aspect of the question has been long settled, and as regards the financial aspect of it, we find on turning to the Health Officer's report that the total expenditure of the health department was, in round numbers, 84,324*l.*, of which 54,942*l.* was provided by the municipality, and 29,690*l.* in the way of income. We are not told how much of this was spent in removing night-soil, but probably the last sum represents a large part of it. The three per cent. cess for removal of night-soil yielded 23,989*l.* Private service yielded most of the remainder, but it is probable that halalcore work was done for which no cess could be raised. And then, on the other hand, we have the accounts quoted from the Health Officer, and from Drs. Klein and Gibbes, showing what the net present result arrived at by the "dry" removal process amounts to as shown by the abominable conditions under which it compels the poor to live, while the epidemic death-rate completes the account. Such an instance in home sanitary administration might possibly justify the issue of a mandamus.

23. It must, however, be borne in mind that efficient house drainage requires an adequate supply of water, and this necessity has been one of the main difficulties in the question of house drainage. To remove it, proposals were under consideration for increasing the collecting and impounding area of the Tulsi reservoir. Catchwater channels had been completed for increasing the supply of Vehar lake, where filter beds were to be provided, and a new 24-inch main led to Bombay. This new main has been considered necessary in consequence of raising the Bhandarwada distributing reservoir 32 feet higher. When completed, it is expected that the water-supply will receive a daily addition of two million gallons, and will enable the city to receive a million of gallons a day more in April and May. So far as we can judge this work appears to be all in the right direction, but there are facts in the Report which prove that not only sufficiency of water is required, but more extensive and better distribution. Gowari village has been dreadfully affected with guinea-worm. Only one person in it had never suffered from this pest. Again, "there is no doubt of the fact that there is not a hamlet "from Kurla to Parel in which the inhabitants do not suffer from deficiency in the supply of pure "water."

Kurla has no water-supply of its own, and "it is exceptionally prone to visitations of cholera." No doubt this catalogue of defects might be increased, but it is unnecessary.

24. In connexion with the projected increase of water, it must be remembered that the whole of it, not lost by evaporation, must be removed chiefly by house drains, which at present have no existence, or it must sink into the subsoil and increase the epidemic susceptibility of the inhabitants.

The small quantity of night-soil removed, 283 tons per diem, will leave the vast mass of the house water-supply, which will be house sewage unprovided for, and we thus arrive at the conclusion of the whole matter, and this is that house drainage in Bombay should be completed with as little delay as possible, and such methods devised for giving effect to it as are best adapted to the domestic habits of the people; while the increased water-supply should be so arranged that it may pass away, after use, by the house drains. So far as we can judge, the costs of halalcore operations would go far if spent in these new directions to cover the whole outlay required for freeing Bombay and its commerce from the risks attending periodical outbursts of cholera and other epidemics.

8th August 1885.

No. 15.

MEMORANDUM of the ARMY SANITARY COMMISSION on the following Papers:—

1. Report on Enteric Fever in the Madras European Army, 1883.
2. Sanitary Report of Madras Army, 1883, by Surgeon-General Madden.
3. Remarks on Surgeon-General Madden's Report, by the Commander-in-Chief, Madras.

As these papers all refer to the same subject, it will save repetition to include them in the same memorandum.

The average strength of non-commissioned officers and men during the year was 10,612. The admissions to hospital numbered 10,517. The deaths were 108, and the invalids sent home 347. The number constantly sick numbered 633·79, or in round numbers 634. The ratios furnished by these data when compared with the previous 10 years' average, were as follows:—

Per 1,000 strength.	1873 to 1882.	1883.
Admissions	1199·79	991·05
Deaths	14·81	10·18
Invalids	40·34	32·70

Of the invalids sent to England in 1883, 19·13 per 1,000 were for change of climate and 13·57 for discharge from the service.

These data show that the sanitary state of the Madras European Army has been undergoing improvement, and as low as was the death-rate of 1883, it may be noted here that 2·74 per 1,000 of it was due to enteric fever.

2. Leaving out the depôts and small stations occupied by numbers too limited to be used in calculating relative ratios, the next abstract shows the stational death-rates for 10 years compared with those for 1883.

Stations.	Death-rates per 1,000.	
	1883.	Previous Ten Years.
Madras and Palavaram	8·38	14·35
St. Thomas' Mount	5·81	15·14
Cannanore	7·26	12·13
Bangalore	11·89	10·30
Bellary	7·10	10·92
Secunderabad	8·78	14·04
Kamptee	18·76	16·35
Burma:		
Thyetmyo	6·07	16·65
Tounghoo	12·55	13·63
Rangoon	20·78	14·64

These stations accommodate above 9,000 troops, and the data afford approximate ratios for sanitary purposes. It is hence not difficult to single out the offenders, while the considerable reductions at the other stations show that there must be something wrong with those stations where the ratios have increased. The figures, taken as a whole, show that the most unhealthy station for Madras troops is Kamptee in the Central Provinces, to which we have called attention in previous Memoranda. Bangalore is another station where death-rates are persistently high, although it is situated in one of the most healthy climates in India. The Burmese rates, with one exception, are high, but improving, and all the remaining stations have yielded results for one year at least, which cannot be considered as other than satisfactory.

3. The chief death-causes of the year were the following:—

	Deaths.
Enteric fever	29
Remittent fever	3
Cholera	10
Phthisis pulmonalis	6
Hepatitis	13
Dysentery and diarrhœa	6

Deaths from other causes are numbered in ones and twos only, and these larger numbers include the chief sanitary problems of the year.

4. It will be seen that by far the most important death-cause of the year was enteric fever, from which there were 94 admissions and 29 deaths. All the deaths from fever, with the exception of three deaths from remittent, were attributed to this fever. In a 10 years' period, 1873 to 1882, the average annual strength was 10,934, and the total fever admissions during the 10 years amounted to 28,760, or in the ratio of 263·03 per 1,000 of the aggregate strength. In the same period the fever deaths were 189, or 1·73 per 1,000, and of these deaths 126 were attributed to enteric fever. It follows that although the admissions from this fever type do not influence materially the admission-rate from all fevers, the fever death-rate depends mainly on the greater or less prevalence of enteric fever, and to the high death-rate from this disease is due the rise in the fever death-rate of 1883 to 3·01 per 1,000, while the previous 10 years' average rate was 1·73 per 1,000.

5. The next abstract gives the prevalence of this fever according to season.

Seasons 1883.	Enteric Fever.	
	Admissions.	Deaths.
1st quarter	7	3
2nd "	14	4
3rd "	60	16
4th "	13	6
Total	94	29

In 1883 the hot and rainy months were those of its greatest prevalence and

6. The usual liability of young ages and early service was observed in 18 s, out of these 94 admissions, and 29 deaths, 71 admissions and 24 deaths took place in m 5 years of age, and 66 admissions and 19 deaths occurred at periods of service under 2 ye e facts are stated simply as confirmatory of past experience, and the practical conclusion is, fever death-rate is mainly influenced by the ages of men sent to India.

7. There are certain apparent anomalies connected with liability to enteric fever to which attention is called by the Surgeon-General. For example, he states that while 19·48 per 1,000 of officers were attacked, none of them died, but that 8·86 per 1,000 of the men suffered, and 2·73 per 1,000 died. In the same way he shows that no children were attacked, but that among women the attacked were in the ratio of 4·86 per 1,000, and the deaths 2·43 per 1,000. As a rule, the admission-rate among officers is higher than in any other class, and the Surgeon-General makes the remark that, "Although "these figures are too few to establish any reliable conclusion, still the greater prevalence of the "disease amongst officers would seem to imply that defective sanitation is not the only cause of the "disease in India, as it is to be presumed that the officers live under better sanitary conditions than "either the men or women." This observation is fully borne out by the facts he cites, as well as by those in regard to age and periods of service already cited, because it is evident that among troops, all of whom are exposed to the same sanitary or insanitary conditions, liability to enteric fever is influenced by age, and by the time men have been in the country. It may be that insanitary conditions act more powerfully at the more susceptible ages, but as an ultimate fact young ages are the fever ages, and it is possible that the greater liability of officers may be due to this element, but if so, it would not account for the non-fatal character of the fever among them, and this raises the question of diagnosis, which lies beyond our sphere.

8. But notwithstanding this aspect of the fact, the present Report contains points of importance regarding local sanitary conditions which we shall next refer to. The first of these is the amount of enteric fever at different stations. This is shown in the next abstract.

Enteric Fever Stations.	Average Strength, 1883.	Enteric Fever.		Deaths per 1,000.
		Admissions.	Deaths.	
St. Thomas' Mount	344	1		—
Bangalore	1,844	11	11	6·0
Bellary	986	8	5	5·07
Wellington	614	4	1	1·6
Secunderabad	2,276	28	7	3·08
Kamptee	693	10	4	5·8
Seetabuldee	50	1	1	20·0
Thyetmyo	659	1	—	—
Total	7,466	94	29	3·88

The first, fourth, and two last stations in this list may be left out of the discussion. But it is evident that there are four enteric fever stations, viz., Bangalore, Bellary, Secunderabad, and Kamptee, which must be dealt with. The facts regarding these stations have been so frequently under discussion that it appears to be scarcely necessary to refer to them, were it not that certain of them are pointedly noticed in the Surgeon-General's Report. Beginning with the negative evidence,

he says, "The strictest attention is paid to the sanitation of barracks and their surroundings, of "latrines, and of food and water-supplies, and no reasonable expenditure that can promote and "protect the health and comfort of the soldier is denied. Latrines are all worked on the dry-earth "system, and kept scrupulously clean, but although dry earth is a most perfect deodorant, it is "impossible to say that it is an equally efficient disinfectant." This merely means that enteric fever takes place where these latrines are in use, but it does not follow that there may not be effluvia, not markedly offensive, that are capable of acting as disease causes. This fact has been long known, and hence the old sanitary rule that immediate removal of all sewage matter to a distance is alone the safe course to follow. "Speedy removal of the defiled earth is aimed at, but it is," he says, "not "always possible to get the soldier to throw in dry earth on using the latrine." Of course neglect of this precaution *pro tanto* nullifies the end of the dry-earth system.

9. Although the food supplies generally are "above suspicion," there is an exception as regards [redacted] and "it is within the range of possibility that milk may at times be supplied in tainted vessels, [redacted] vendors do not appreciate or understand the fastidiousness of the European in the matter of [redacted]. In fact, the native idea is that water of any kind purifies everything with which it comes [redacted]"

[redacted]ow how far it may be possible to find a practicable remedy for this practice, but we [redacted]mind, notwithstanding the occurrences of enteric fever cases among women already [redacted] milk drinkers, the women and children, usually escape enteric fever.

[redacted]ts are of general application to all stations, as is also the fact that water sources for tr[redacted]ully guarded and periodically analysed. But here we are met by the Bangalore experie[redacted] with its foul water source and its 6 per 1,000 enteric fever death-rate in 1883. Practically there has been no real change in the water-supply from the Ulsoor tank of this large station since its dangerous character was laid before the Royal Commission of 1859. The singular thing is that the facts and their importance are admitted by everybody, and yet nothing is done. The last thing tried was boiling the water.

"With reference to the Ulsoor tank and its dependent wells which supply the whole of the "waters used by the troops at Bangalore, the Medical Officer, North Station Hospital, remarks. "... This channel (the feeder of the tank) was from time to time during the year defiled by "the Natives, who used it as a latrine, and the water of the lake itself was polluted by Natives "washing in it themselves, their clothing and cattle."

11. Referring to the causes of enteric fever at this station, the Medical Officer of North Station Hospital says:—"No insanitary defects could be discovered within barracks. The water-supply "(mixed water from the Ulsoor tank and Dhobie's wells as usual) was impure from contamination "by excrement and filth of every description. There is not only the immediate danger from pollution "of the water-supply tank, but as a portion only of the filth washed into it becomes oxidized and "innocuous, the remainder is deposited on the bed of the tank, ready to give forth in the dry season, "when the water is low and the bed of the tank (125 acres in extent) is exposed to the sun, the "noxious vapours which, in conjunction with the use of the water, predispose to, if they do not "directly cause, the fatal form of fever."

This statement regarding the condition of Ulsoor tank in dry weather introduces for the first time an element of disease into the discussion which has never hitherto been mentioned. The alleged fact should be further inquired into, and some attempt might be made to trace any time relation which may exist between the drying up of the tank and the appearance of enteric fever among troops. It has been long known that there is a relation between fever types, including typhoid fever, and the condition of pond surfaces. Even in India there is reason to believe that such relation has shown itself at Neemuch and elsewhere, and the importance of the fact as regards Bangalore, if it should turn out to be correct, would point to the draining of the tank and cultivating its area as parts of the necessary remedy for this fever.

12. Referring to the condition of the tank as well as to the state of the water, the Surgeon-General himself says, "The conditions referred to in these extracts are in my opinion sufficient to "account for the prevalence of enteric fever at Bangalore," and he further expresses his opinion that, if great care had not been exercised in purifying the tank water before use, "there would have "been, instead of isolated cases, a general outburst of the disease."

13. The Adjutant-General, in referring to the water-supply of Bangalore, states that it is got "from the Ulsoor tank and the Dhobie's wells, is filtered at the tank, and then distributed in pipes "by steam power. On delivery it is passed through Mackenzie's filters, and from July to October "1883 it was further deemed advisable to boil it before issue. The water-supply of this station is "precarious and scanty, and liable to dangerous pollution. During the year the subject received "the earnest attention of Government, and it is hoped that in due time it will be found practicable "to give Bangalore, which has so many other advantages as a military station, a better water-"supply." This statement might have been made any time within the last quarter of a century, but the new aspect given to the whole question by the Surgeon-General in the present Report, appears to show that while better water should be provided as a necessity, the state of the tank in dry weather and its relation to fever should be investigated.

14. Kamptee stands next in order of liability in enteric fever, with its death-rate of 5·8 per 1,000. The Deputy Surgeon-General, however, states that the sanitary condition of the barracks and lines, the food, and water "have not led to any conclusions that they are the origin of the disease, so far as

"these matters are controlled by the regimental and medical authorities." The relation of enteric fever at Kamptee to seasonal influence is stated as follows:—"The cases occurred only during the "last four months of the south-west monsoon, and at the same season that fevers caused by malaria "are most prevalent here, and from the similarity to remittents in some cases, it is," I think likely," he says, "that the enteric fever at this station is in some way connected with malarial influences."

The question may here be asked whether any part of the station is liable to flooding during the monsoon to such an extent as to give rise to slow drying up of the ground or to disturbance of the subsoil and wells?

In the course of the year the remodelling of the infantry barracks at this station was completed, and "they are now well raised above the ground, have broad verandahs and excellent ventilation." The effect of these improvements on the amount of fever should be noted, but from the facts as they stand it appears probable that the condition of the subsoil at the station and in its neighbourhood may exercise a not unimportant influence on the amount of fever.

15. As already stated, the death-rate from enteric fever at Bellary was 5·07 per 1,00[illegible] account is given of the reasons for this high death-rate.

16. *Secunderabad* yielded 28 enteric fever cases and 7 deaths in 1883, equal to [illegible] 3·08 per 1,000. The following account of the cases is given by the Medical Officer [illegible] hospital:—"The manner in which the cases occur, scattered through the bar[illegible] "at different periods of the year, appears to point to a common origin o[illegible], "which originating cause is always in existence, and to which all the men [illegible]pose "themselves, such a source of disease might easily be found in the filth of [illegible]zaars "and Native prostitutes' houses."

This amounts to a statement that, although much has been done for improvi[illegible] of troops at this station in past years, there are still general filth causes in places to [illegible]esort which may predispose them to enteric fever. But there are other disease-causes at [illegible]hich attention has long been directed. "There is some wet land under cultivation near the [illegible]antry barracks "which it would be desirable to drain and plant with trees, but this has [illegible]id practicable, "as the owners object." This wet land has often been complained of, an[illegible]ot be drained we may suggest that a belt of vegetation might be planted between it and the [illegible]s. The following statement is made about the drainage:—"The drainage of the barracks was improved and is now as "good as it can be without a proper system of surface drainage," which is of course what is wanted.

17. There is another serious disease-cause which requires notice here, although it relates to cholera. It is stated as follows:—"One of the greatest defects in the station is the total want of proper drainage "from the town of Secunderabad. At present the whole of the sewage runs by the back of the staff "lines into the Husain-Saugor tank, by which the health of the neighbourhood is being fast ruined. "In February the General was attacked with cholera, and in August the wife of the European "whom he left in charge of his house, died of cholera; a lady, two days after, returning from the "hills, was attacked and died of cholera." The stench arising from the drain is sometimes overpowering. In the same station there are also said to be "various gravel pits, which, on rain falling, "get filled with water, which becomes putrid as evaporation proceeds." It does so because of the amount of filth it carries with it from the surface and subsoil of the station, of which the putrescence is an index.

We are glad to learn from the Adjutant-General's remarks that this subject of the Secunderabad drainage has been brought to the notice of the Resident at Hyderabad, "and it is hoped that measures will be taken to remedy it."

18. The fever group, taken together, yielded the following admissions and deaths in 1882:—Eruptive fever, 14 admissions, of which 9 were from small-pox, and one death from the latter disease. Continued fevers, 531 admissions, including 94 from enteric fever, of which, as already stated, 29 proved fatal. Paroxysmal fevers, 853 admissions and three deaths.

Including cholera, the whole fever group gave an admission-rate of 134·38 per 1,000 and a death-rate of 4·14 per 1,000 of which 2·74 per 1,000 was due to enteric fever, leaving 1·4 per 1,000, as the year's death-rate from all other fevers.

The year 1883 was not one of the fever years among European troops, for the admission-rate was 47·46 per 1,000 lower than in 1882, although the greater prevalence of enteric fever had added 0·81 per 1,000 to the fever death-rate. The admission-rate from fevers on a ten years' average, 1873–1882, had been 263·03, and the average death-rate 1·73 per 1,000.

In 1883 the purely febrile diseases gave an admission-rate of 130·39 per 1,000. The years 1878 to 1880 were epidemic years, and yielded admission-rates of 340·8, 397·3, and 450·6 per 1,000, but the year 1883 yielded the highest fever death-rate of the entire 11 years.

19. *Cholera.*—Separating this disease from the febrile group, it is stated to have occasioned 19 cases and 10 deaths. The latter took place at the following stations:—

Stations.	Deaths from Cholera.
Bellary	1
Secunderabad	5
Kamptee	3
	9
On the march	1

The enteric fever stations were the stations which yielded the deaths from cholera in 1883, and the sanitary details already given for these stations are sufficient to indicate the probable local predisposing conditions of both diseases. It is worthy of remark, however, that one enteric fever station, Bangalore, escaped cholera.

We have no details as yet as to the extent to which cholera prevailed in the vicinity of any of the stations, so that the history is incomplete.

20. The only other death-causes which appear to require notice are dysentery and liver diseases. The former yielded three deaths, one at Kamptee and two at Rangoon. Hepatitis and abscess of the liver caused 17 deaths. Four of these took place at Madras and St. Thomas' Mount, three at Cannanore, one at Bangalore, one at Secunderabad, two at Kamptee, four at Rangoon, one at Tongboo, and one on the march.

21. These details appear to be sufficient for our purpose of tracing the relation of the health of troops to sanitary and personal conditions for the year under review, and the facts taken as a whole warrant the following conclusions:—

(1.) Making allowance for the fact that 1883 was not an epidemic year from fever, the history of the Madras European Army shows that its health has undergone great improvement concurrently with advances which have been made in sanitary works, in general administrative measures, and apparently in improved personal habits of the men.

(2.) As shown by the mortality from enteric fever and cholera, Kamptee, Bangalore, Secunderabad, and Bellary are the stations chiefly instrumental in keeping up the death-rates at present.

(3.) With regard to the three first of these stations, there are sufficient facts in the present Report on which to urge strongly the necessity for proceeding without further delay to provide Bangalore with good water. The new points raised in the Report as to the state of the Ulsoor tank in dry weather should be further submitted to skilled inquiry.

(4.) The facts regarding Secunderabad point to the necessity for more active sanitary supervision of all places frequented by troops, or for keeping the troops out of them. The question of drainage is also one of urgency.

(5.) No satisfactory account has yet been given of the reasons why Kamptee is so subject to enteric fever and cholera. The data in the present Report appear to point to undrained subsoil as a not improbable cause, which, at all events, might be inquired about.

Lastly,—The present Report has pointed out the stations to which high death-rates are due, and it would be most advisable to concentrate effort on their improvement.

10th April 1885.

No. 16.

Memorandum of the Army Sanitary Commission on the Medical History of the European Troops in the Bombay Command for 1883.

1. This Report, as its name implies, is almost exclusively devoted to departmental details, and, except in the statistical portions of it, there is little calling for remark.

The sanitary details regarding the more important stations have lately been fully described by the Sanitary Commissioner with the Government of Bombay, and his reports are, we believe, under consideration by the executive authorities, in whose hands the important questions which have been raised by Mr. Hewlett may be safely left. On some practical sanitary points there are differences of opinion with him in the present report, which are attended with obvious disadvantages to the public service. But a course of proceeding suggested further on for avoiding such differences would apparently be the fairest for all parties.

2. The outward-bound trooping service during 1883–84 was performed by 10 voyages of the usual troopships and by a company's steamer.

The following numbers arrived at Bombay during the season:—

Officers	635
Ladies	124
Children	101
Men	12,392
Women	433
Children	535
Female servants	31

The earliest arrival at Bombay was on the 22nd October 1883. The latest was on 5th April 1884; but by the beginning of February, which is about the latest safe period for arrival in India, the whole of the troops had arrived, except 151 officers and 3,083 men.

3. During the outward voyages, which may be taken at about a month's duration, there were 1,229 admissions to hospital from among the troops, of which 321 were for primary syphilis, 39 for secondary syphilis, and 271 for gonorrhœa and its consequences. The men are all supposed to have gone on board free of disease, and they had furnished, nevertheless, 631 admissions from different forms of venereal diseases, or more than half the admissions from all causes during a voyage of about a month's duration.

4. There were four deaths during the voyage, two of these were from drowning, one from rheumatism, and one from sunstroke. Among the admissions there were 197 cases of itch, an occurrence requiring separate mention.

5. Of 535 children embarked, 12 died during the voyages, and 7 of the deaths took place on board the "Euphrates," which made the voyage by the Cape. These casualties resulted from the usual infantile complaints. One woman died of bronchitis. "The sanitary condition of the various troopships was good, and the accommodation sufficient."

6. The return voyages were performed by the troopships and two other steamers, the first of which left Bombay on the 31st October 1883, and the latest on the 1st May 1884, conveying with them to England the following numbers:—

Officers	467
Ladies	147
Children	188
Men in health	8,297
Women	416
Children	925
Invalids, men	1,634
„ women	137
„ children	344
Insanes	93
Convicts, &c.	12[illegible]

Of invalided men, 997 left India after the beginning of April, and would arriv[illegible] weather.

7. We shall next abstract the statistical facts bearing on the health of troops serving [illegible]ombay stations in 1883, which were as follow:—

Average strength, 11,183.

Admissions	13,679	=	1223·2 per 1,000.
Constantly sick	631·87	=	56·50 „
Deaths	116	=	10·37 „
Invalids for change	332	=	37·65 „
Invalids for discharge	89		

These ratios show improved and improving health. The preceding four years' average ratios were for—

Admissions	1835·5 per 1,000.
Deaths	16·67 „
Invalids	49·79 „
Constantly sick	65·65 „

The most important admission causes were the following:—

	Admissions.
Paroxysmal fevers	4,234
Continued fevers	592
Digestive system	2,038
Primary syphilis	691
Secondary syphilis	224
Gonorrhœa	1,073
Sequelæ of do.	180
	9,032

To fevers, venereal diseases, and diseases of the digestive organs, 9 out of every 13 admissions to hospital were due.

8. The following were the death causes of the year:—

Diseases.	Deaths.
Small-pox	1
Enteric fever	15
Remittent fever	8
Other fevers	2
Cholera	9
Tubercular diseases	4
Other constitutional diseases	4
Nervous diseases	17
Circulatory diseases	7
Respiratory diseases	11
Digestive	13
Others	1
Poisons	3
Injuries	10
Total	111

Of the three deaths entered under the head of "poisons," one was occasioned by alcohol, one by delirium tremens, and one by stings of insects.

The last two death causes in this list do not properly belong to causes connected with the stations. They represent more or less constant quantities, and the time seems to have arrived for separating in

all the armies those deaths due to locality from deaths due to extraneous causes, and this is the more necessary because violent deaths would otherwise account for an increasing percentage of the mortality, while the deaths due to preventible disease were diminishing with the advance of sanitary work. Apart from this added ratio, the disease deaths in 1883 were only 8·75 per 1,000 for the Bombay European Army, and our present object is to try whether this disease death-rate cannot be further reduced by sanitary work at the stations. Deaths due to drink and to accidental causes, or to suicides, belong rather to the sphere of general army administration than to that of the sanitary administration, and, while the latter ought to be fully credited for the result of its proceedings, it should not be charged with deaths over which it has no control.

9. If the present disease death-rate were to become an average rate, the sanitary administration, instead of confining its attention mainly to reducing the mortality, would have to take up the question of inefficiency, as this is represented by the admissions, daily sick, and invaliding, and to [illegible] their reduction by dealing with the stations individually. No doubt this is to a certain [illegible] at present, but when an army presents a death-rate no higher than that due to the same [illegible] life, and yet has too many men not in the ranks but in hospital, it seems to be time [illegible] part of the question and to deal with it separately. Of course these remarks are [illegible] knowledge that all the elements of inefficiency are subject to considerable variations [illegible] the same stations, but there are stations which bear the stamp of unhealthiness [illegible]

[illegible] as an example. The average strength of troops at this station in 1883 was 621. [illegible]on-rate was 1471·8 per 1,000. The death-rate was 16·10 per 1,000. The previous 10 [illegible]erage had been for admissions 1877·9, and for deaths 17·44 per 1,000. Now it is obvious that there must have been something wrong in this case. But we must deduct from the admission-rate what may be called personal diseases, namely, those of the venereal type, which in 1883 accounted for no fewer than 202·6 per 1,000, and there would be left 1269·2 per 1,000, while we find that of this high rate no less than 389 per 1,000, or nearly a third of the whole, were due to fevers. Of these fevers 25 cases were diagnosed as "enteric" fever. The sanitary questions connected with these Karachi fevers, and with the general degradation of the health of troops, have been discussed year after year, and have been specially reported on by Sanitary Commissioner, Bombay, with the result that probably the safest and most economical way of dealing with the whole question would be to remove the troops to Ghizree.

With the well-known facts about Karachi before us, and which we have often reported on for the information of the executive authorities, what can be said about a statement such as the following in the present Report? "As regards the outbreak of this enteric fever at Karachi, no direct cause in "point of sanitation, &c. has been found, but the Medical Officer in charge of the station hospital is "of opinion that the rainfall has some connexion with this fever, and that it occurs some days after "rainfall." Of course the practical conclusion from such a statement must be that, as the executive authority cannot control the rainfall, nothing can be done. This is one of the cases to which we alluded at the commencement of the present Memorandum, and the contradiction might have been avoided by a brief conference with the Sanitary Commissioner before drawing up the Report.

11. Another case is even of more administrative importance. The Sanitary Commissioner for Bombay, Mr. Hewlett, was specially directed to report on the sanitary condition of Nasirabad, and his report gives a very complete account of the whole locality, indicating clearly what ought to be done with the question, and advising certain improvements in details. This report had somehow fallen into the hands of the Surgeon-Major at the station, and he, while concurring with some of Mr. Hewlett's proposals, objects to others. We are not concerned with the question which officer is right, although we have little doubt on the subject in any matters of sanitary experience, but the very obvious question presents itself as to whether this method is the best possible for dealing with a large and very important question, and whether it would not have been better to follow our home example in such cases in discussing the details with the officers on the spot, who, it must be remembered, are responsible before reports are finally completed. Reports of specially qualified officers, when sent in, are intended to afford materials for enabling the executive authority to arrive at practical conclusions, and ought never to be subject to contradictions such as these.

12. The extent to which enteric fever prevailed at the Bombay stations in 1883 is shown in the next abstract, and we have added the cholera mortality:—

Stations.	Enteric Fever.		Cholera.	
	Cases.	Deaths.	Cases.	Deaths.
Colaba	3	2	—	—
Deolalee	1	—	3	2
Aden	4	—	—	—
Karachi	25	2	—	—
Poona	3	2	2	—
Ahmednagar	5	1	5	4
Mhow	2	2	1	—
Nasirabad	1	—	2	1
Indore	3	1	1	1
Deesa	1	—	—	—
Quetta	13	5	—	—
Total	60	15	14	8

These figures show a mortality of 25 per cent. of the cases of enteric fever. Excluding a fatal case of cholera on the march, there were 14 cases and 8 deaths from cholera at these enteric fever stations, and these two epidemic diseases may be safely assumed as indices of the sanitary defects at them. Mr. Hewlett has in his reports given the results of special local inquiries made by him at several of them, and in our Memorandum on his Report on Bombay Presidency for 1893 we have abstracted his description of the barracks at Ahmednagar, which fully accounts for the occurrences in the preceding table.

13. At certain stations the liability of troops to fevers generally is much greater than at others. Thus, for example, Nasirabad yielded a fever admission-rate of 1,042·4 per 1,000, Neemuch of 1,032·4, Indore of 1,043·4, Mhow of 958·8, Baroda of 755·9, and Asirgash of 6·64 per 1,000. And at the other extreme of the scale, we have Belgaum yielding 99·1 per 1,000, Kolhapur 20·4, and Khandala 23 per 1,000. There are, of course, reasons, general or local, for these differences, and they can be discovered, and as far as possible removed by the sanitary service. As regards several of the feverish stations, the causes and remedies are both known.

As we have already suggested, it is by pursuing sanitary work in this direction that improved army efficiency is to be sought for, rather than in lower death-rates. As it is thoroughly recognized that fever, of all diseases, affects the stamina of troops most, we expect greater energy on the part of executive authorities in dealing with its causes.

14. *Venereal Diseases.*—These diseases prevail to a very considerable extent in the Bombay Army, although the proportion is apparently less in places where there are lock hospitals.

The following have been the admission-rates per 1,000 from primary syphilis and gonorrhœa (which may be assumed as showing the relative amount of infected cases), and excluding all secondary cases, during the last five years:—

Years.	Admissions per 1,000.	
	With Lock Hospitals.	No Lock Hospitals.
1879	207	284
1880	207	256
1881	161	284
1882	129	330
1883	133	278

These rates are favourable to the effects of lock hospitals, and it might be advantageous to compare the procedure at the Bombay lock hospital stations with that followed in other Presidencies where the results have not been so satisfactory. But, at the same time, all the facts of the case should be stated, otherwise there may be grounds of fallacy. On this account it appears to be desirable to quote the following annual totals, showing the admission-rate per 1,000 from all venereal diseases, primary and secondary, in the Bombay Army, since 1872, from Dr. Cuningham's Report:—

Years.	Admissions per 1,000 from all Venereal Diseases.	Years.	Admissions per 1,000 from all Venereal Diseases.
1872	176·4	1878	254·8
1873	215·6	1879	296·8
1874	202·2	1880	261·6
1875	200·2	1881	245·2
1876	207·8	1882	229·5
1877	293·1	1883	225·1

If we assume what may be called the general venereal infectedness of the Army, and apply the test of time to its amount, as is done in this abstract, it would appear as if the lock hospital comparison would have to be modified in its value. So that, even admitting the apparent falling off in primary admissions at lock hospital stations, the total amount of disease, unless otherwise accounted for, would apparently have increased since these hospitals were introduced. The fact merely shows the necessity of taking all the circumstances into account before arriving at a conclusion as to the value or otherwise of the present police system.

15. The most satisfactory statements made in this Report are those showing the improved health of all ranks in the Bombay European Army, of which the following brief statement contains the results:—

Classes.	Ratios per 1,000 Strength.			
	Ten Years.		1883.	
	Deaths.	Invalids.	Deaths.	Invalids.
Officers	13·85	83·10	5·90	61·95
Non-commissioned officers	19·07	50·58	13·59	43·05
Privates	14·27	49·41	9·94	36·92

It is impossible to overlook the significance of these figures, proving, as they do, not only what has been done, but what can still further be done, for improving the health and efficiency of the Bombay European Army. But their teaching reaches much further than to this result, for the argument is unanswerable that, if so much can be done for strangers to Indian climates and conditions of life, at least a similar result in its degree ought to be attainable for the Native population, and this, in its turn, would react on the health of every regiment in the Presidency. It is time that these violent epidemic outbursts which we have discussed in our Memorandum on Dr. Hewlett's Bombay Report should be taken in hand and dealt with. There is much to be done by the military executive before all epidemic disease causes have been removed at military stations. The causes are known, and their remedies, at least enough to justify present practical action; while, as regards the population groups, among which the troops are stationed, the causes are known, but the remedies have still to be applied by the civil authority. This deficiency, however, in no way detracts from the credit justly due to those who have brought the health standard of the Army to its present position.

Our conclusions then are:—

1. That very satisfactory progress is being made in the sanitary condition of European troops.
2. That the stational improvements advised by Mr. Hewlett, and the details supported by the opinion of the principal Medical Officer should be carried into effect as quickly as pecuniary reasons admit of.
3. That village improvements, especially of those in the vicinity of stations, should be taken in hand, and proper executive means for giving effect to them should be provided.

This will be found to be one of the most effectual methods for protecting the health of troops, especially during epidemic seasons.

6th August 1885.

No. 17.

MEMORANDUM of the ARMY SANITARY COMMISSION on REPORTS of FAIRS and FESTIVALS held within the PRESIDENCY of MADRAS during the latter months of 1883 and part of 1884.

These papers contain local reports of administrative and medical officers on the sanitary condition of places where fairs and festivals were held, together with notices of instances in which cholera appeared during the period of occupation.

The Reports give details regarding 12 festivals in 1883, and 129 in 1884. But the estimated attendance is stated only in 37 instances, and in these it amounted to 1,161,600 persons, besides the usual numbers of animals. We may safely estimate the attendance at all the fairs and festivals as about 2,000,000.

Of the 12 festivals held in 1883 cholera appeared at three.

At one of these, Karthagia, in South Arcot, 14 cases of cholera were reported from among 20,000 people; but, as there were no deaths, the diagnosis seems doubtful. At Mayavaram, in Tanjore, there were three deaths from cholera, but the attendance is not stated. At Tirupati, in North Arcot, there were six deaths from cholera from among 40,000 people. At Karthagia and Mayavaram the cleansing was reported as "insufficient," and at Tirupati "tolerable." But here the element of epidemic intensity has to be taken into account, for these three places are situated in districts which suffered most from cholera in 1883, and the epidemic was severe in the districts at the time when the fairs were held. The cholera death-rate for the whole Presidency was 1·2 per 1,000. In Tanjore it was 3·0 per 1,000. In South Arcot it was 3·1 per 1,000, and in North Arcot 1·4 per 1,000, while at the Tirupati festival the death-rate among 40,000 pilgrims was 0·15, or about a tenth part of the district rate. The facts are of importance, because this Tirupati festival, according to contagion views, has been a centre from which cholera has radiated.

We have no means of contrasting the deaths from cholera at fairs during the subsequent year, 1884, with the district rates, as these have not yet been reported. We can only discuss the facts by themselves, and these are as follow:—

In 1884 there were 129 fairs and festivals up to the dates of the Reports. At one fair cholera was in the town, but no pilgrims suffered. This town was Thai Pusam, in Madura, and its sanitary condition was reported not good. In another town, Denkanikota, in Salem district, the sanitary state of which was reported bad, cholera prevailed in town at the time of the fair, and there appear to have

been seven deaths among pilgrims. Besides these affected town examples, cholera deaths among pilgrims and other attendants took place at the following fairs:—

Locality and District.	Numbers present.	Sanitary Condition as reported.	Deaths from Cholera.
Chidambaram (South Arcot)	5,000	Not good	7
Yekadesi, Trichinopoly	5,000	Satisfactory	24
Trirangam "	Not stated	Not good	20
Mannergudi (Tanjore)	Not stated	Bad tank	12
Another fair (Tanjore)	Not stated	Bad tank	11
Tanjore	15,000	Insufficient	11
Tinnevelly	15,000	Indifferent	5

Including the seven deaths in the cholera affected town, Denkanikota, there were thus 97 deaths at these eight fairs. The history, however, as already stated, is incomplete without a knowledge of the local incidence of cholera in the districts during 1884; but the history of cholera during December 1883 appears to show that, in the districts where cholera affected fairs were held in 1884, cholera had passed over in considerable intensity from the preceding year's epidemic. Thus we find the cholera deaths in December 1883 for these districts to have been,—

	Cholera Deaths.
South Arcot	1,642
Trichinopoly	1,472
Tanjore	2,319
Tinnevelly	4,372
Salem	1,194

These districts which yielded all the festival deaths of 1883–84 were those in which the mortality from cholera was by much the greatest in December 1883.

It is highly probable, therefore, that local cholera intensity was a factor in these festival outbreaks, besides what may have been due to bad sanitary condition.

The facts may be summed up as follows:

Fairs and festivals, 1883–84	141
Escaped cholera deaths	131

Cholera appeared at 10. Arranged according to districts, the attacked localities of 1883–84 were situated as follow:—

Districts.	No. of Fairs.	No. where Cholera appeared.	Deaths from Cholera, 1883–84.
North Arcot	2	1	6
South Arcot	3	1	7
Tanjore	15	4	37
Trichinopoly	2	2	44
Salem	22	1	7
Tinnevelly	5	1	5
Total	49	10	106

The cholera outbreak of 1883–84 among pilgrims and attendants at fairs was hence confined to 10 fairs out of 49 which took place in six districts where cholera prevailed severely in 1883, and probably in part of 1884. It is necessary to bear this last fact in mind, because of the risk always present of blaming pilgrimages for spreading cholera, instead of blaming the bad sanitary condition of towns and districts for pilgrim attacks.

The remaining 131 fairs and festivals which escaped the disease altogether took place in 12 districts. In describing the sanitary condition of the places where these festivals were held, the terms "good" and "sufficient" are applied to nearly all of them; but it must be stated that the mortality from cholera among the population of these districts where the festivals escaped was very much less in 1883, at least, than it was in the districts where they suffered.

Taking the aggregate pilgrim population at two millions, the cholera death-rate among them would be 0·053 per 1,000, while the Presidency rate, on a five years' average, was 0·6 per 1,000, and for 1883 double this amount, or 1·2 per 1,000, or 23 times the amount of the pilgrim losses.

The general result of this experience is, that, although much life has been saved at these festivals, more vigour should be displayed in rooting out the known predisposing epidemic causes in the towns and villages of Madras Presidency. A study of these Reports shows that this can be done by simple and well-devised regulations under supervision for ensuring constant cleansing and keeping clean. This, with simple surface drainage and improved dwellings and protection of water sources, will do far more for the public health in small towns and villages than the execution of costly permanent works where trust is reposed in these for safety, and cleanliness is neglected.

24th July 1885.

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CLASS

REPORT

ON

SANITARY MEASURES IN INDIA IN 1884-5:

TOGETHER WITH

MISCELLANEOUS INFORMATION UP TO JUNE 1886.

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REPORT.

I.—EUROPEAN ARMY OF INDIA.

Sickness and mortality in 1884.

The health of the European Army of India in 1884 was not so favourable as in the previous year. The admission-rate per 1,000 of an average strength of 54,996, according to the report of the Sanitary Commissioner with the Government of India, was 1,513 against 1,336 in 1883, the daily sick-rate 67 or 4 per 1,000 in excess of 1883, and the mortality 12·56 against 10·88. The loss to the army on account of invaliding was 32 per 1,000 or nearly 1 per 1,000 less than in 1883, making a total loss from death and invaliding of over 44 per 1,000, a ratio identical with that of the previous year, but 18 per 1,000 less than the average loss of the ten-year period 1870-79.

The following statement shows the sickness and mortality among the British troops of the three Presidency armies and of all India for 1884 and the previous year:—

Presidency.		Average Strength.	Ratio per 1,000 of Average Strength.		
			Admissions into Hospitals.	Daily Sick.	Deaths.
Bengal	1883	34,079	1,463	66	11·21
	1884	33,486	1,662	70	11·68
Madras	1883	10,498	1,013	59	10·19
	1884	10,785	1,109	57	8·53
Bombay	1883	10,948	1,249	57	10·50
	1884	10,725	1,455	65	19·39
India	1883	55,525	1,336	63	10·88
	1884	54,996	1,513	67	12·56

As will be seen from the above, sickness was most prevalent among the Bengal troops, while in point of mortality the Bombay portion of the army showed the worst results, which was due chiefly to the high cholera death-rate among the troops serving in Southern Afghanistan. The Madras troops were the most healthy, and the mortality among them (8·53 per 1,000) was the lowest on record.

The chief causes of admission into hospital in the Bengal and Bombay armies were malarial fevers; in all three Presidencies the ratios were in excess of the previous year, especially in Bengal, where the admission-rate rose from 486 per 1,000 of average strength to 683. Among the Madras troops malarial fevers caused an admission-rate of 166 per 1,000, being an increase of 38 on the previous year; and in the Bombay Presidency the admission-rate under this head was 504 per 1,000 against 436 in 1883. Venereal diseases, as usual, were a prolific source of inefficiency among the European troops, especially in Madras, where they headed the list of the causes of admission. As regards mortality, enteric fever again comes first, the death-rate for the entire army from this disease being 2·74 per 1,000, an increase of 0·34 on the previous year. Cholera also gave rise to a higher death-rate, viz. 1·95 against 0·92 in 1883, which was mainly due to the prevalence of the disease in the portion of the Bombay Army serving in Southern Afghanistan. But for this outbreak of cholera in Afghanistan the cholera mortality would have stood at 1·23 per 1,000.

Of the six groups of stations in Bengal, sickness was more prevalent than in 1883 in Bengal Proper, Meerut and Rohilkund, Agra and Central India, and Punjab, the exceptions being the Gangetic Provinces and Oudh group and Hill stations, and in all groups malarial fevers and venereal diseases were the chief causes of sickness. The same four groups also recorded a higher mortality, but the ratios of 1884 were in all cases below the average of the twenty year period 1860-79. In all groups excepting the Hill stations enteric fever gave rise to the highest proportion of deaths; the Agra and Central India group recorded the highest ratio from this cause, viz., 7·51 per 1,000, the next highest occurred in Meerut (4·19), Gangetic Provinces (3·96), and Lower Bengal (3·18). Cholera was more fatal in the Meerut and Gangetic Provinces groups, with death-rates of 4·19 and 3·17 respectively; it was less fatal in the Agra (1·75) and Bengal Proper (1·06) groups; while the Punjab and

Hill stations groups were exempt from the disease. The next diseases causing the largest proportion of deaths were hepatitis, respiratory diseases, and dysentery.

In individual stations of an average strength exceeding 200, which were occupied throughout the year, the highest admission-rates were recorded at Delhi (4,828 per 1,000), and Meean Meer (3,554); six other stations had ratios over 2,000 per 1,000. The highest mortality of any such station was recorded at Quetta, viz., 38 per 1,000 against a previous 10 years' average of 13·17, Hyderabad in Sind followed with 32·68, and at five other stations the death-rates varied between 20 and 31 per 1,000.

In the Hill stations of Bengal the troops, numbering 9,244, enjoyed better health than in 1883, the admission-rate having fallen from 1,454 to 1,201, while the death-rate fell from 6·33 to 5·91 per 1,000, which was the lowest on record since 1870.

Among the troops comprising the Rajputana, Malwa, Sind, and Aden group, the general health was on the whole good, though both the admission and death-rates were in excess of the previous year, but below the decennial averages of 1870–79. Of an average strength of 4,464 the admissions to hospital were in the ratio of 1,548 against 1,502 in 1883, and the death-rate 12·77 as compared with 8·32. The chief causes of death were enteric fever (2·02), apoplexy and sunstroke (1·79), cholera (1·12), and hepatitis (1·12). At the two largest stations of this group, Mhow and Aden, the admission-rates were 1,799 and 1,167, and the death-rates 6·69 and 8·51 respectively.

In the Deccan and Nagpur group (average strength 7,132) there was a little more sickness than in 1883, the admission-rate having increased from 1,001 to 1,171; still it compares favourably with 1,383 the average rate of the ten years 1870–79. The death-rate was only 8·83, nearly 2 per 1,000 less than in 1883, and 5·31 below the decennial average. Enteric fever gave rise to nearly one-fourth (2·11) of the deaths, other fevers following with 1·12, and hepatitis 1·68; from cholera the death-rate was 0·42. At Secunderabad, which is the largest military cantonment in India, the admission-rate per 1,000 of an average strength of 2,394 was 1,077, and at Poona, the next largest in this group, 1,129; their death-rates were 9·61 and 9·81 respectively.

The health statistics of the troops included in the Southern India group were also favourable. Of an average strength of 4,786 the admission-rate was 1,059 against 1,126 in 1883, and a 10 years' average of 1,235; while the death-rate, 7·73, was one of the lowest on record, and considerably below the average. The most fatal disease was cholera, which contributed 1·46 to the total mortality, while enteric fever, apoplexy and sunstroke, and hepatitis each contributed 1·04. Of the seven stations in this group, the two largest, Bangalore and Bellary, recorded admission-rates of 1,026 and 963, and death-rates of 4·07 and 7·15 respectively.

The average strength at the four stations in the British Burma group was 1,785; here the admissions were higher than usual, being in the proportion of 1,190 per 1,000 against 980 in 1883, and 1,092 the last decennial average; on the other hand the mortality was low, namely, 7·28 against 10·00 in the previous year, and a 10 years' average of 17·32. There were no deaths from enteric fever in this group; the chief causes of mortality were dysentery (1·68), hepatitis (1·12), and phthisis pulmonalis (1·12). In Rangoon, which is the largest station, the admission-rate was 1,586, and the death-rate 12·43 per 1,000, both ratios being greater than in 1883.

Among the small force of 757 troops located in the Hill stations of Madras and Bombay during 1884 the admission-rate rose from 1,059 per 1,000 in 1883 to 1,531, but the death-rate declined from 8·63 to 5·28, which was little more than a third of the average mortality of the 10 years 1870–79.

During the year 1,441 men, belonging mainly to the Bombay Army, were stationed in Southern Afghanistan, and among them the admission-rate was 2,056 per 1,000, and the death-rate 68·70, thus comparing most unfavourably with the Bombay Army as a whole. Malarial fevers were the chief causes of admission, but cholera gave rise to the greatest mortality, viz., 27·07, enteric fever following with 7·63, other fever 6·94, respiratory diseases 6·25, apoplexy and sunstroke 4·17, and dysentery 4·17, all being much higher than in the preceding year.

Cholera.

Cholera was more prevalent in the European Army of India in 1884 than in the previous year, the number of cases having increased from 82 to 150, and the deaths from 51, or 0·92 per 1,000 of average strength, to 107, or 1·95. The disease was of a more virulent character than usual, as is shown by the fact that the per-centage of deaths among those treated was 71·33 against 62·20 in 1883, and 62·24 in 1882. Of the total cases, 67 occurred in the Bombay army, of which 52 were fatal, but these unfavourable results, as already stated, were mainly owing to the prevalence of the disease among the troops stationed in Southern Afghanistan, where there were 49 cases and 39 deaths. In the Bengal Army, also, there was a greater number of cholera cases

under treatment than in 1883, namely, 71 against 48, while the fatal cases rose from 32 or 0·24 per 1,000 of average strength to 45 or 1·34. There were but 12 cases in the Madras Army, and of these 10 or 0·93 were fatal, the same number as in 1883.

Small-pox was less fatal among the European troops. There were in all 78 cases against 105 in 1883, and 8 deaths or 0·14 per 1,000 against 9 or 0·16. Bengal contributed 6 of the deaths and Madras and Bombay one each. Small-pox.

Intermittent fever was very prevalent during 1884, and gave rise to an admission-rate of 487 per 1,000, against 359 in 1883. This increase, however, was not accompanied by an increased mortality, for in both years there was but one death under this head. Remittent and continued fevers were also more prevalent, the admission-rate for the army as a whole having increased from 49 per 1,000 in 1883 to 60 in 1884, and the death-rate from 0·41 to 0·62 per 1,000. Still the admission-rate compares favourably with 162, the last decennial average. The increase mainly occurred in the Bombay Presidency, where the admissions per 1,000 rose from 31 in 1883 to 85, while in Bengal they fell from 62 to 60, and in Madras they rose from 30 to 36. Fevers.

Enteric fever continues to increase among the European troops. During 1884 there were 644 cases, equal to 11·7 per 1,000 of average strength, against 429 cases, or 7·7 in 1883; the mortality also rose from 133, or 2·40 per 1,000, to 151 or 2·74. All three Presidencies contributed to the increase in admissions, but the increase in mortality was confined to Bengal and Bombay, where the death-rates rose from 2·52 to 3·31 and from 1·55 to 2·05 per 1,000 respectively, while in Madras the mortality fell from 2·86 to 1·67. The statistics of newly arrived regiments in regard to this fever show most unusual results, the death-rate being only 2·33 of the total mortality against 8·95 in 1883. In other respects also the health of these troops was better than that of soldiers of longer residence in India. The year's statistics again point to the conclusion that young and unacclimatised soldiers are particularly subject to this fever. Among men under 25 years of age, the death-rate from this cause was 4·61 per 1,000, while between the ages of 25 to 29 it was 1·83. The relationship between enteric fever and length of service was also well defined, for while the mortality among troops during their first and second year's residence was 5·47, among those in their third and sixth years it was only 1·55. Enquiries were again made by medical officers during the year with the view of tracing the causation of the disease, but it is stated that in the great majority of cases no clue whatever could be found in any local insanitary conditions. The Army Sanitary Commission notice that the admission-rate from this fever in the Indian army (11·7 per 1,000) was ninefold that of the Home Army (1·3), and that the Indian death-rate (2·74) was twelvefold that of the Army at home (0·24). "The "contrast," they say, "is otherwise of importance, because it shows that, as both the "Indian and Home armies contain many young men, there must be some other factor "besides youth to account for this difference of liability to fatal fever. No doubt "heat and other climatic influences add to enteric fever liability in India, but the "amount of this liability cannot be estimated until we shall have freed Indian stations "from those local fever causes which we know from home experience to be connected "with liability to enteric fever in the colder climates of home stations. There is "plenty of evidence to show that these local causes are closely related to the subsoil "conditions under and around barracks in India, and that it would be very advisable "to deal practically with at least one enteric fever station on this ground. There is "also experience to show that enteric fever stations are liable to outbreaks of cholera, "and the relation of local insanitary conditions to the latter disease is proved by the "arrest put on it by the removal of troops. It is even not at all improbable that "change from an enteric fever station into a healthy camp might be of use."

Venereal diseases yielded an admission-rate of 294 per 1,000 against 270 in 1883, Each of the three Presidency armies shared in the increase, particularly Bombay, where the admissions rose from 218 per 1,000 in 1883 to 292. Madras, again, recorded the highest rate, viz., 307 against 289, and among the Bengal troops the rate was 291, or 10 per 1,000 higher than in 1883. In spite of police and lock hospital precautions, the admissions from these diseases continue to increase, and for the whole army have risen from a 10 years' average (1870–79) of 203 per 1,000 to 294 in 1884. "The whole subject," the Army Sanitary Commission state, "appears to be surrounded with insurmountable difficulties, for in every Government "the disease has advanced in the face of every means of prevention which have "been adopted." Venereal diseases.

Invaliding.

The invaliding rate for the European Army of India as a whole was 31·74 per 1,000 of strength against 32·66 in 1883. The proportions contributed by each of the Presidencies were remarkably even, that of Bengal being 31·84, Madras 31·82, and Bombay 31·36. Of the 1,757 men invalided, 41 per cent. were for discharge as unfit for further service, which is a higher per-centage than for the three previous years, and was due entirely to the large increase of 12 per cent. (33 against 21) in the Bombay Army, for in the Bengal Army the ratio was the same (45) as in 1883, and in Madras it fell from 40 to 36. In each Presidency the chief causes of invaliding were anæmia, debility, hepatitis, and phthisis pulmonalis. Young men under 25 years of age yielded the highest per-centage of those invalided, viz., 38·70, which was larger by 2·15 than in the preceding year. As regards the effect of length of residence in India upon invaliding, the largest per-centage (49·97) occurred, as usual, among men of two to five years' residence; among men under two years' service the per-centage was 24·19 against 18·94 in the previous year.

II.—NATIVE ARMY.

In the Native Army of India, the results of 1884 were on the whole favourable. Of an average strength of 114,827 the admissions into hospital were in the ratio of 1,042 per 1,000 against 923 in 1883, the daily sick 33 against 31, but the death-rate fell from 11·76 to 10·50, thus showing that the type of sickness in 1884 was of a less severe character. Including deaths among men absent from their regiments, the mortality for the year was 12·22 per 1,000 against 14·31 in 1883. Sickness and mortality in 1884.

The sickness and mortality of the various portions of the Native Army are given in the following Table:—

		Average Strength.	Ratio per 1,000.			
			Admissions.	Daily Sick.	Deaths.	Total Deaths, including Absentees.
Bengal Native Army	1883	40,932	985	32	10·55	13·98
	1884	40,850	1,198	35	10·97	12·56
Madras ditto	1883	27,703	737	27	10·76	12·51
	1884	28,050	836	31	10·02	11·82
Bombay ditto	1883	23,576	994	35	12·81	14·96
	1884	23,373	1,153	38	12·96	14·35
Central India Regiments	1883	5,197	595	19	7·89	10·16
	1884	5,082	644	20	5·90	7·23
Punjab Frontier Field Force	1883	10,438	1,419	45	21·46	23·35
	1884	10,458	1,262	36	10·71	14·00
Hyderabad Contingent	1883	6,983	572	20	7·59	9·31
	1884	7,014	574	19	4·56	5·30
India as a whole	1883	114,830	923	31	11·76	14·31
	1884	114,827	1,042	33	10·50	12·22

As will be seen from the above, in all three Presidencies there was an increase in the admission and daily sick rates, but a decrease in the total mortality compared with the previous year. Malarial fevers were, as usual, the chief causes of sickness, and accounted for 503·2 of the total admission-rate against 387·4 in 1883. Respiratory diseases caused the greatest mortality, viz., 2·97 of the total death-rate, against 3·91 in 1883, "a fact which," the Army Sanitary Commission observe, "suggests inquiry "regarding clothing and shelter, whether both are suited to the diverse climates where "the Native Army serves." The next highest mortality (1·80 per 1,000) resulted from fevers, and next in order came cholera (0·71).

In the Bengal Command sickness and mortality were more prevalent than in 1883, still, on the whole, the health of the troops was more favourable than usual. As shown above, the admission-rate was considerably greater, but the rise in mortality was very inconsiderable. Intermittent fever was the chief cause of sickness, the admissions from which rose from 398 to 595 per 1,000 of strength. Bowel complaints also caused more sickness, the ratio of admissions having risen from 67 to 99 per 1,000. Respiratory diseases were again the chief death causes, but it is satisfactory to learn that the mortality under this head continues to decline, namely, from 4·50 per 1,000 in 1882 and 3·20 in 1883 to 2·77 in the year under notice. Fevers, on the other hand, showed a considerable increase in mortality, from 1·32 to 2·40 per 1,000. Cholera and bowel complaints were also more fatal, cases of the former having risen from 38 to 41, and the deaths from 23, or 0·56 per 1,000, to 29, or 0·71. Bengal Native Army.

The principal statistics of the several groups of the Bengal Army were as follows :—

		Average Strength.	Ratio per 1,000.		
			Admissions.	Daily Sick.	Deaths.
Bengal Proper and Assam	1883	6,100	1,408	46	16·23
	1884	5,882	1,367	42	14·61
Gangetic Provinces	1883	7,315	970	34	8·17
	1884	7,500	929	32	6·00
Rohilkund and Meerut	1883	5,813	978	36	11·53
	1884	5,180	1,188	43	10·62
Agra and Central India	1883	5,028	906	31	5·77
	1884	4,722	1,312	37	7·84
Punjab	1883	15,279	830	24	10·80
	1884	14,728	1,083	29	8·49

In every group fevers were the chief causes of sickness, and only in the Bengal and Assam group were they less prevalent than in 1883. Bowel complaints occasioned more admissions in every group, and respiratory diseases were on the whole as prevalent as in the previous year. As regards mortality, the ratio of 1883 was exceeded only in the Agra and Central India group, which registered a death-rate of 7·84 in 1884 against 5·77 in 1883. Cholera was present in all the groups but the Punjab; in the Agra and Central India group the death-rate under this head was 1·06 per 1,000 against none in the preceding year, and in the remaining three groups the mortality was less. Fevers were more fatal in all the groups but the Gangetic Provinces, where there was a slight reduction. Bowel complaints gave rise to a higher mortality in the Rohilkund and Meerut, Agra and Central India, and Punjab groups than in 1883; in the latter group, however, the increase was very slight. The mortality from respiratory diseases was in all cases less than it had been in 1883, especially in the Punjab, where the ratio fell from 4·97 to 2·78.

Of individual stations in the Bengal Command occupied throughout the year, Dhuki and Gumbuz, with an average strength of 278 men, recorded the highest admission-rate, namely, 3,194 per 1,000, and 12 others recorded rates varying from 1,500 to 2,000. The highest death-rate (68·35) also occurred at the above station, and four others had death-rates exceeding 20 per 1,000. "It is not at all unlikely," the Army Sanitary Commission observe, "that skilled sanitary inquiry would find some "reason for these rates."

There was a satisfactory reduction in sickness and mortality among the troops comprising the Punjab frontier force. The chief causes of sickness were, as usual, fevers, which contributed more than one-half of the admissions; respiratory diseases came next, but with a much smaller ratio than the previous year, namely, 72·5 per 1,000 against 109. Altogether there were 112 deaths in this force, of which 54, equal to 5·16 per 1,000 of strength, were from respiratory diseases. In the preceding year the deaths from this cause numbered 148, or 14·18 per 1,000. This force was exempt from cholera during the year.

The health of the Central India Regiments was again very favourable. Sickness was somewhat more prevalent, compared with 1883, but the mortality, which was very low, fell from 7·89 to 5·90. The actual number of deaths was 30, of which 12 resulted from respiratory diseases. There was only one cholera case in this force and this proved fatal.

The statistics of the Hyderabad Contingent were, as usual, extremely favourable. The admission-rate was identical with that of 1883, but the death-rate (4·56) was 3 per 1,000 less. Respiratory diseases were the chief causes of mortality and yielded 9 of the total 32 deaths. Cholera was fatal in two out of three cases.

Madras Native Army.

The health of the Madras Native Army as a whole was again very favourable. Sickness was slightly more prevalent, the admission-rate having increased from 737 per 1,000 in 1883 to 836 in 1884, and the daily sick-rate from 27 to 31 per 1,000; but the death-rate declined from 10·76 to 10·02, or including absent deaths, from 12·51 to 11·82. Intermittent fever accounted for the largest number of admissions, and

respiratory diseases for the largest mortality, namely, 48 deaths (or 1·71 per 1,000) out of a total of 281. From cholera there were 80 cases and 41 deaths, or 1·46 per 1,000 of strength, against 173 cases and 81 deaths, equal to 2·92 per 1,000 in 1883. Fevers yielded 44 deaths, or 1·57 per 1,000, and bowel complaints 31, or 1·11 per 1,000. Small-pox cases numbered 100, but only 6 proved fatal.

The most unhealthy of the large stations in this Command was Secunderabad, which recorded an admission-rate of 1,416 per 1,000, but the highest mortality was recorded in Toungoo (22·88), and the next highest at Secunderabad (18·55). Of the 64 deaths at the latter station, 27 were due to cholera, whilst in Toungoo there were no deaths from this disease. At Bangalore, which is the largest station, the total deaths were 22, or 6·27 per 1,000, and of these two resulted from cholera.

Bombay Native Army.

The Bombay Native Army was not quite so healthy in 1884 as in the two previous years, sickness being more prevalent and the mortality somewhat greater. As in the other branches of the Indian Army, fevers stand first as causes of admission, and were in the proportion of 570 per 1,000 of strength against 399 in 1883. The deaths in hospital numbered 303, or 12·96 per 1,000, of which 105, or 4·49, were due to respiratory diseases, 42, or 1·80, to fevers, and 40, or 1·71, to dysentery and diarrhœa. Of the various portions of the Bombay Native Army, sickness was most prevalent in the stations occupied in Southern Afghanistan and the Persian Gulf. At Dhuki, Gundakindoff, and Bolan Pass the admission-rates were 4,433, 3,257, and 3,073 per 1,000 respectively. The highest mortality (42·84) was also returned from the first of these stations, respiratory diseases being the chief causes of death, and numbering 13 out of a total of 29. Amongst individual regiments, that of the 12th Bombay Native Infantry, at Pishin and its outposts, recorded the highest mortality, namely, 66·19 per 1,000 of an average strength of 753.

III.—GENERAL POPULATION.

Vital Statistics.

Registration of vital statistics in India makes but slow progress; in some few provinces there has been a marked improvement, but on the whole registration is still very imperfect. At present it is impossible to arrive at any satisfactory idea of the birth-rate, as in Bengal, with a registered population of 66,163,884, births during 1884 were registered only in 47 of the principal towns, having a population of 1,685,651. The total population under registration in eleven provinces, including Calcutta, in 1884 was 198,146,858, and the actual registered deaths numbered 5,239,218, or 26·44 per 1,000, exceeding the number of the previous year by 633,570; but then 1883 was an exceptionally healthy year, while 1884 was comparatively unhealthy, owing chiefly to an abnormal dryness in the summer, followed by excessive autumnal rains. "The "entire year's increase and more," the Army Sanitary Commission remark, "was due "solely to epidemics, and this fact affords the only clue to the required remedies. "The epidemic and local causes in India are quite well known, but up to the present "time the epidemic statistics show conclusively that little or no reduction of them has "been made by the sanitary executive, where there happens to be one."

The following table shows the mortality from the four chief diseases, and also that from all causes in the different provinces during 1884 as compared with the death-rate of the previous year:—

Provinces.	Cholera.		Small-pox.		Fevers.		Bowel Complaints.		Deaths from all Causes.		
	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000 of Population under registration. 1884.	1883.
Bengal, excluding Calcutta	134,421	2·03	18,533	0·28	966,233	14·60	58,376	0·88	1,378,610	20·83	18·82
Calcutta	2,272	5·24	478	1·10	3,618	8·35	1,209	2·79	13,256	30·59	28·44
Madras	75,476	2·67	61,247	2·17	215,977	7·66	28,775	1·02	650,335	23·07	18·98
Bombay	13,304	0·84	14,438	0·88	276,989	16·83	35,983	2·19	408,409	24·82	25·53
Punjab	614	0·03	16,416	0·87	465,556	24·71	18,346	0·97	600,298	35·04	25·25
North-Western Provinces and Oudh	30,148	0·63	202,541	4·59	1,074,097	24·35	76,508	1·73	1,555,342	35·26	27·57
Central Provinces	149	0·02	4,882	0·55	145,342	16·48	21,991	2·49	240,714	27·30	34·53
Berar	87	0·03	615	0·23	30,551	11·60	9,319	3·54	64,808	24·63	51·36
Assam	22,276	4·92	4,781	1·05	66,527	14·69	16,157	3·56	132,992	29·37	27·14
British Burma	5,515	1·51	6,102	1·67	29,514	8·08	3,719	1·02	69,234	18·95	14·67
Mysore	330	0·08	3,241	0·77	33,207	7·93	4,970	1·19	62,531	14·93	15·11
Coorg	—	—	108	0·61	2,292	12·85	90	0·50	2,689	15·08	21·75
Total	285,087	1·43	333,382	1·68	3,309,903	16·70	275,443	1·39	5,239,218	26·44	23·20

Bengal.

Registration of births in Bengal continues to be confined to selected towns. In the year under review, 47 towns situated in 20 districts returned 39,640 births, equal to 23·51 of their population, which is an advance of 1·43 per 1,000 on the ratio of 46 towns in the previous year. The registered deaths for the whole province numbered 1,378,610, or 20·83 per 1,000, against 1,245,676, or 18·82, in 1883. As usual there were great diversities in the death-rates of individual districts, ranging from 10·93 in Durbhanga to 39·60 in Nuddea. "Taking the year's results as a whole," the Army Sanitary Commission remark, "they show that considerable progress is being made "with the important work of registration of deaths. The Government is quite alive "to the importance of the work, and may be safely left to do the best that can be "done with it."

From all the chief diseases more deaths were registered than in 1883. Cholera was very prevalent, and the deaths rose from 90,439, or 1·36 per 1,000, to 134,421, or 2·03. All the districts were affected, and nearly 11 per cent. of the total 227,615 villages. The disease was specially severe in the Orissa division, and considerably more so than in the other three divisions of the province. On the whole there were 17,983 fatal cases in Orissa, or at the rate of 4·95 per 1,000 of population in 20·86 per cent. of the villages against 6,631 deaths, or 1·82 per 1,000, in 8·26 per cent. of the villages in 1883. The three districts of Cuttack, Poori, and Balasore, comprising this division, returned cholera death-rates of 4·16, 3·52, and 7·79 respectively, the latter being the highest district death-rate of the year. The Army Sanitary Commission remark that

" nothing new in the history of cholera has been revealed by the experience of 1884. " It is the old history repeated year after year of great numbers of population groups " scattered over the surface of Bengal living under very bad sanitary conditions and " a cholera epidemic, whence coming no one knows, but swooping down in a most " irregular manner on certain of these groups, and leaving others of them until a " future season, and the practical conclusion is simply that had these attacked groups " been in a healthy condition they would have almost, if not altogether, escaped " the epidemic of 1884." One noteworthy feature in the cholera history of the year was the exemption of fairs from the disease. Only in a very few instances did cholera manifest itself, which was attributed to the sanitary measures adopted.

Small-pox caused nearly twice as many deaths as it did in 1883, namely 18,553, or 0·28 per 1,000, against 9,714, or 0·14. As usual children were the chief sufferers, no less than 72·27 per cent. of the mortality having occurred among those under 12 years of age. All the districts were affected but Darjeeling and Julpigoree, but all the deaths were returned from less than three per cent. of the total villages, the mortality being thus essentially local in its incidence.

The fever mortality was the greatest on record, and the deaths numbered 966,238, or 14·60 per 1,000, against 913,766, or 13·81, in 1883. In 1871 the registered fever mortality stood at 169,505, or 2·56 per 1,000, and since then the deaths have steadily increased year by year, making great strides of late years, during which the Sanitary Commissioner, Dr. Lidderdale, says, more care has been accorded to registration, while no circumstances have occurred which justify the belief that the province generally is getting more feverish than before. As regards the incidence of fever in different districts, it is satisfactory to learn that the mortality has diminished very considerably in some of the worst localities, notably in Burdwan and Birbhum, where the fever death-rate has fallen from 28·86 and 27·62 respectively in 1882 to 18·81 and 19·53 in 1884. In discussing the fever history of the year the Army Sanitary Commission notice the relation of fever prevalence to sanitary defects, and while admitting that good sanitary work was done during the year, they urge that greatly increased activity is necessary, especially in villages. " If the villages are improved as they ought to be," they say, " the fatality of fever will become less year after year, but the amount of fever is " connected with the subsoil water, which in its turn is dependent on the drainage " outlets, and it will continue pretty much as it is until they, too, are made efficient."

From bowel complaints the mortality was somewhat greater and pervaded a more widespread area. The registered deaths rose from 55,270, or 0·83 per 1,000, in 1883 to 58,376, or 0·88; but it is believed that the deaths under this head are generally under-estimated.

The year 1884 was exceptionally unhealthy in Calcutta, and the deaths rose from 12,325, or 28·44 per 1,000, in 1883 to 13,256, or 30·59. The city was visited by a severe outbreak of cholera in March, April, and May, causing 1,616 deaths out of a total mortality from this disease of 2,272. Small-pox also prevailed to an unusual extent causing 478 deaths against 73 in 1883; and fever deaths rose from 3,442 to 3,618.

Madras.

The steady rise of the birth-rate in the Madras Presidency which had marked the preceding five years was continued; in fact more births were registered during 1884 than in any year since 1869, and they numbered 827,381, or 29·3 per 1,000, against 791,774, or 27·7, in 1883. By districts the birth-rates ranged from 17·1 in Nilgiris to 41·4 in Chingleput; and in all districts, excepting Godavari, Tanjore, and Tinnevelly, births were in excess of the deaths, the average excess amounting to over 6 per 1,000. The comparatively low rate in Nilgiris is attributed partly to imperfect registration, " but " I am credibly informed," the Sanitary Commissioner, Mr. Bidie, states, " that it is " common for low country natives living on the hills to send their wives to the " plains to be confined."

On the whole the year was an unhealthy one. The rainfall was above the average, but the rains were unseasonable and unequally distributed, and there was a falling off in the crops; still food grain was plentiful, and, except in some few instances, the common sort was generally cheap. The registered deaths numbered 650,335, or 23·1, against 541,930, or 19·0 per 1,000, in 1883, the increase being ascribed partly to improved registration, but mainly to the prevalence of epidemic disease. That there is still room for improvement in death registration is shown in the district death-rates, which ranged from 14·5 in Nellore and in Ganjam to 35·7 in Tanjore.

Cholera was largely prevalent during 1884, causing 75,476 deaths, or 2·67 per 1,000, against 36,284, or 1·27, in 1883. The disease was present in all the districts except South Canara, and its incidence in Ganjam, Vizagapatam, Kurnool, and the Nilgiris

was very slight. Nearly a third of the cholera deaths (23,671, or 11·1 per 1,000 of population) occurred in Tanjore district; the mortality under this head was also very high in Tinnevelly, viz., 9·6; South Arcot following with 4·4, Trichinopoly with 3·7, and Madura with 3·5 per 1,000. The high mortality at Tanjore caused much anxiety to Government. Surgeon-General Furnell, M.D., paid a special visit to Tanjore, and was of opinion that the cause of the continued prevalence of cholera in the district was most probably owing to the peculiarly contaminated water-supply upon which the people were dependent. He further believed "that the habits of the people and their "mode of life in the delta portions of the district largely contribute to the upkeep of "cholera in their midst. They live in the midst of irrigated lands, and, when the "rivers have dried up, take very little care of the drinking water supplies. While the "district is a wealthy one regarding its agricultural produce, the actual labourers "are very poor and live in wretched hovels built on a damp porous soil." In his concluding remarks on this epidemic the Sanitary Commissioner states: "The general "death-roll of the Presidency will show how much has yet to be done to protect the "people of Southern India from epidemic disease, and that our efforts must not be "confined to periods when sickness is prevailing, but be continuous and systematic. "Fortunately, too, the sanitary precautions which have been found most effectual in "warding off cholera are equally valuable for the prevention of other diseases." "In "this statement," the Army Sanitary Commission observe, "the necessities of the "case are fully recognised, and a great change would soon come over the public health "of the Presidency if sanitary work in some degree corresponded to them."

Small-pox was also unusually prevalent, and the deaths rose from 37,975, or 1·33 per 1,000, in 1883 to 61,247, or 2·17 per 1,000. This was the highest death-rate that had been recorded for 14 years excepting the famine year 1877, when there were 88,321 deaths from small-pox. Every district suffered, but the disease was most severe in Kistna and Godavari, which recorded death-rates of 6·7 and 6·3 per 1,000 respectively. Of the total small-pox deaths 11,781 occurred among children under one year of age, and 27,511 between one and 12 years, together numbering 39,292, or 64 per cent. of the total small-pox mortality. The disease was very destructive in Madras town, where the death-rate was 2·9 per 1,000 of population; so serious was the epidemic that Government appointed a special health officer as a temporary measure and passed an Act rendering the vaccination of children between the ages of 3 and 12 compulsory. No less than 74 per cent. of the small-pox deaths in Madras town occurred among children under three years of age. "As might be anticipated," Mr. Bidie states, "it raged with greatest severity in the most crowded and dirtiest "quarters of the town." In the opinion of the Army Sanitary Commission "the "history as a whole leads to two conclusions; 1st, that there is a high degree of "epidemic susceptibility to the action of small-pox, and 2nd, that much improvement "is required in the vaccination service."

From fevers the deaths rose from 203,786, or 7·04 per 1,000, in 1883 to 215,977, or 7·66, a ratio identical with the last quinquennial average. In 10 districts out of 22 the fever mortality ranged from 15·1 to 9·0 per 1,000, and in the other districts the ratios varied from 7·7 to 1·9 per 1,000. No information is given as to the local conditions accompanying these high fever death-rates, but the Army Sanitary Commission again point out that it is only by strict attention to sanitary matters that we can expect reduction. "The measures required are purely practical," they say, "and our desire for information might admit of an answer that there had been quite "enough reporting already, but far too little effective sanitary work."

Bowel complaints were also widely prevalent, and caused 28,775 deaths, equal to 1·02 per 1,000 of population, against 22,098, or 0·77 in 1883. "When cholera is "epidemic," the Sanitary Commissioner remarks, "bowel complaints are more frequent "than usual, but at the same time there cannot be a doubt that some deaths due to "cholera are registered under the milder term."

The public health of Madras city during 1884 was very unsatisfactory, the deaths having increased from 15,882, or 39·8 per 1,000 of population, to 20,123, or 50·48. Of the total deaths, 4,074 were from small-pox and 1,358 from cholera, both of which diseases were present in an epidemic form, and exceeded the mortality of the previous year by 2,117 and 1,189 respectively. The mortality among the infantile population was very great, more than a third of the total deaths having taken place among infants under one year of age, and nearly a fourth of the children in the city under five years of age died during the year.

Bombay.

Important changes in registration were made in the Bombay Presidency during 1884. The compilation of vital statistics were from the 1st of July of that year

entrusted solely to Deputy Sanitary Commissioners, an arrangement which brings them into direct communication with every village in their districts. Certain registration districts were also re-arranged, and the areas of the new districts have been made conterminous with collectorates in which the same language is spoken.

The health of the Presidency during 1884 was on the whole good, though fever was more fatal than usual, which the Sanitary Commissioner (Mr. Hewlett) attributes to the late and unseasonable rainfall. The registered births of the year amounted to 534,723, or 32·50 per 1,000, a higher ratio than in any year since 1874, and 2 per 1,000 in excess of that of 1883. By districts the birth-rates ranged from 43·43 per 1,000 in Dharwar to 16·91 in Hyderabad, thus showing the defectiveness of registration. The registered deaths fell from 420,198, or 25·53 per 1,000, in 1883 to 408,409, or 24·82, which was made up of death-rates varying between 15·55 per 1,000 in Thar and Parkar and 35·15 in Broach. It is hoped that these extreme ratios will be more equalized under the new registration arrangements. A little over 45 per cent. of the total deaths occurred among children under five years of age.

Cholera was considerably less prevalent than in 1883, the deaths having fallen from 37,954, or 2·31 per 1,000, in that year to 13,804, or 0·84, in 1884. The disease prevailed over the whole Presidency, but its incidence was very irregular, and less than 6 per cent. of the total 24,536 villages suffered. The disease was most severe in Dharwar, which returned a death-rate of 5·27 per 1,000, and in this district 33 per cent. of its villages were affected. In discussing the cholera mortality of the year the Army Sanitary Commission trace the connexion of the disease with localising influences, and they arrive at the conclusion "that the future safety of the people depends on the "extent to which efficient sanitary work is done or neglected to be done. What the "rural districts require is an efficient sanitary executive."

Small-pox accounted for 14,438 deaths, or 0·88 per 1,000 of population, against 13,404, or 0·81, in 1883. In spite of the effective vaccination service which Bombay has had for some years, small-pox appears to be on the increase, as is shown by the fact that the mortality in 1884 was more than four times as great as the average of the five preceding years, viz., 0·21. Of the total deaths, 3,723 were registered as under one year of age, and 5,413 between the ages of one and 12, about two-thirds of the mortality having thus taken place among young children.

Fever was generally prevalent over the entire Presidency, and yielded 276,989 deaths, or 16·83 per 1,000, against 266,741, or 16·21, in 1883. From bowel complaints the registered deaths numbered 35,983, or 2·19 per 1,000, which is a decrease of 691 on the mortality of the previous year. It is noticed that the same districts which suffered most from cholera, Belgaum and Dharwar, also returned the highest death-rates from bowel complaints, namely, 5·43 and 5·33 per 1,000.

The city of Bombay was more healthy in 1884 than in the previous year, the total number of deaths being 22,542, or 27·29 per 1,000, against 23,530, or 29·12, in 1883. The decrease was chiefly under cholera and small-pox, the deaths from the former having declined from 1,027 in the previous year to 576, and from the latter from 1,461 to 112. Fevers, on the other hand, caused 6,830 deaths, or 30·30 per cent. of the total mortality, against 5,903 in 1883.

Since the commencement of 1884 registration of vital statistics in the Punjab has been carried out by Civil Surgeons of districts under the orders of the Local Government. The results bear evidence of considerable improvement, the registered births having increased from 734,912, or 39 per 1,000, in 1883 to 809,912, or 42·98, in 1884. The increase was general throughout the province; only four districts recorded birth-rates below 34 per 1,000. In all the districts but six the births exceeded the deaths. A further sign of improvement in registration is revealed in the results obtained in the 49 large municipalities, the average birth-rate of which equalled 42 per 1,000. Punjab.

The year was somewhat unhealthy. The registered deaths numbered 660,298, or 35·04 per 1,000, exceeding the mortality of 1883 by 134,557, or nearly 10 per 1000. This large increase was attributed partly to improved registration, but mainly to the great prevalence of fever during the autumn months. The highest death-rates were returned from the districts of Ludhiana, Karnal, Umballa, Delhi, Ferozepore, Hoshiarpur, and Gurdaspur, and ranged from 40 to 65 per 1,000; while only in seven districts was the mortality below 25 per 1,000. Young children were the chief sufferers, more than a half of the total deaths having occurred among those under five years of age.

Of the chief diseases cholera was less prevalent than usual, and caused 614 deaths, or 0·03 per 1,000 against a previous five years' mean of 0·36. The disease was

confined to a few districts, and only in Kangra did it appear in an epidemic form causing 526 of the total cholera deaths. Out of a total of 35,972 villages in the province the entire mortality was returned from 97. The Sanitary Commissioner (Dr. Bellew) reports that the history of the disease at Kangra was not available.

Small-pox was much more prevalent than in 1883. The deaths numbered 16,416, or 0·87 per 1,000, against 12,103, or 0·64, in 1883. All the districts were affected, Karnal recording the highest death-rate, viz., 4·20 per 1,000; but this rate was exceeded in some of the towns, in two of which, Jagadhri and Shahabad, the mortality reached 5·77 and 5·87 per 1,000 respectively. Of the total deaths, 4,713 occurred among children under one year of age and 10,772 between the ages of one and twelve.

More than two-thirds of the total deaths of the province were registered under fevers. These amounted to 465,556, or 24·71 per 1,000, a greater number than in 1883 by 159,371, or 8·46 per 1,000. The fever mortality of 1884 was also greater than in any previous year, excepting the scarcity year 1879, and was attributed chiefly to the excessive rainfall. The districts most affected were Ludhiana, Umballa, and Karnal, which recorded death-rates of 52·95, 45·12, and 40·38 per 1,000 respectively. The city of Karnal suffered most severely, and returned the enormous fever death-rate of 70·42 per 1,000 of its population numbering 23,133. The Deputy Commissioner reported that hardly an inhabitant escaped fever, and that death must have visited almost every family. In these trying circumstances, it is reported, the Civil Surgeon and his staff did good work in administering medical relief, and great services were rendered by the Deaconness and ladies of the Zenana Mission, who won the gratitude of all by their indefatigable exertions and ready sympathy. "The practical teaching of the year's experience is," the Army Sanitary Commission state, "that more activity is required in improving the sanitary condition "of villages, including the draining and general improvement of village sites, and "that these district fever-rates should be studied with reference to the influence of "drainage defects on the public health, and the means of their removal, so far as this "may be practicable."

From bowel complaints 18,346 deaths were registered, equal to 0·97 per 1,000 of population, against 14,607, or 0·77, in 1883. The mortality was generally diffused over the province, but its incidence was local, for only 11 per cent. of the villages returned deaths.

North-Western Provinces and Oudh.

Each year witnesses to an improvement in the registration of births and deaths in the North-Western Provinces and Oudh. General registration was introduced into the provinces in 1879, when the recorded birth-rate was 28·69 per 1,000; since then the ratio has been gradually increasing, until, in 1884, it stood at 43·77 per 1,000, the number of births registered being 1,930,961 against 1,801,401, or 40·84, in 1883. The improvement seems to have been general, for only three districts, Dehra Dun, Kumaun, and Allahabad, showed imperfections. These three districts also returned the lowest death-rates.

The year 1884 was, on the whole, an unhealthy one, which was due to a considerable extent to an excessive rainfall during the autumn months. The deaths were more numerous than in any year since 1870, excepting the famine year 1879, and in 1884 numbered 1,555,342, or 35·26 per 1,000, against 1,216,297, or 27·57, in 1883. So high was the mortality in some parts of the provinces that nine districts returned death-rates in excess of the birth-rates. Nearly a third of the total deaths occurred among children under one year of age.

Cholera was more prevalent than in 1883, and the deaths rose from 18,160, or 0·41, in that year to 30,143, or 0·68 per 1,000 in 1884. All the districts suffered with the exception of Garhwal and Lalitpur, but the disease was epidemic only in the trans-Jumna districts of Hamirpur, Banda, Jalaun, and Jhansi, especially in the two first. The Sanitary Commissioner (Dr. Planck) observes that "this epidemic prevalence may, perhaps, be "considered a continuance of that recorded in Banda during the years 1883 and 1882, "which appeared to take its origin from the Allahabad Kumbh fair of the year last "mentioned." But the Government of India in their Orders on the Sanitary Commissioner's Report point out that from the facts adduced in Dr. Cuningham's Report for 1882 it appears clear that no such foundation exists. "The sanitary condition of "the towns and villages of Banda," they say, "coupled with scanty and bad water-"supply during certain seasons of the year, is sufficient to account for the persistence "with which the disease has clung to this district during the last three years. The "true safeguard is the removal of these localizing influences."

The mortality from small-pox was greater than in any year since 1876. No less than 202,541 people perished from the disease or in the proportion of 4·59 per 1,000 of population, against 138,641, or 3·14, in 1883. The epidemic was spread over the entire province, but its severity was mainly confined to the districts of Oudh, five of which yielded death-rates ranging from 19·35 to 10·69 per 1,000. The Lieutenant-Governor in his Orders on the Sanitary Commissioner's Report says: "The liability "of Oudh to small-pox epidemics is without doubt due to the failure to extend "vaccination in that province. It may be hoped that this state of things will now "be remedied. Signs are not wanting that the severe mortality of the last two years "has had some effect in increasing the belief in the efficiency of vaccination, and very "commendable efforts have been made in some districts to further the operations of "the Vaccination Department."

From fevers the registered deaths amounted to 1,074,097, or 24·35 per 1,000, against 830,258, or 18·82, in 1883. The mortality appears to have been very high in irrigated districts, 12 of which returned an average death-rate of 35·33 per 1,000. The Government of India notice that Dr. Planck reiterates his statements "that irrigated districts "afford higher death-rates from fevers than others; but as he adds that this difference "is especially marked 'in years characterized by plentiful autumn rainfall,' and thus "renders it uncertain how much of the fever-inducing cause may be separately "attributed to either condition, he has been asked to confine his attention to the "discovery of any direct relationship which may exist between canal irrigation and "the prevalence of fevers."

Bowel complaints accounted for a larger number of deaths than in the previous year, namely, 76,508, or 1·73 per 1,000, against 66,530, or 1·51, in 1883; but the mortality was not excessive when compared with a previous five year's average of 1·79.

Central Provinces.

The vital statistics of the Central Provinces for 1884 show that 368,086 births were registered during the year, being in the ratio of 41·75 per 1,000 of population, against 357,864, or 40·59, in 1883. In no district was the birth-rate below 37 per 1,000, which indicates improvement in registration; and everywhere births were more numerous than deaths, the excess for the province being 14·4 per 1,000. The registered deaths fell from 304,763, or 34·56 per 1,000, in 1883 to 240,714, or 27·30, a decrease of 64,049, which the Sanitary Commissioner, Dr. J. H. Loch, attributed to the general healthiness of the year. Nearly a third of the total deaths occurred among children less than a year old and more than half among children under five years of age.

Cholera was remarkably little prevalent, there being only 149 deaths registered during the year, which is a great decrease on 16,235, the number recorded in 1883, and a smaller mortality than in any year since 1874. Of the total deaths, 84 occurred in Nimar district and 29 in Chanda, the rest being spread over six other districts. Only 40 of the total 27,674 villages of the province were affected. At the two great fairs of the province, Birman and Ramtek, cholera was present only in the former, where there were five cases and four deaths among the pilgrims.

Small-pox, on the other hand, was more prevalent than usual, and gave rise to 4,882 deaths, or 0·55 per 1,000, a higher ratio than in either of the three preceding years, but considerably below the mean of the previous five years ending 1883, viz., 1·04 per 1,000. The disease prevailed in every district of the province, and it affected more than 7 per cent. of the villages. Of the total deaths, 1,968, or 40 per cent., occurred among children under one year of age, "a result which appears to show," the Army Sanitary Commission remark, "that too small a proportion of the children born is "vaccinated within the year."

From fevers 145,342 deaths were registered, equal to 16·48 per 1,000 of population, against 175,119, or 19·86, in 1883. In nearly every district the death-rates were lower than in the previous year, and in several instances the decrease was large. The highest district ratio was 25·28 in Narsinghpur and the lowest was 6·66 in Nagpur.

The deaths registered under bowel complaints amounted to 21,991, or 2·49 per 1,000, against 26,623, or 3·02, in 1883.

Berar.

The new system of registering vital statistics which was introduced into Berar on 1st January 1883 is reported to be working well and efficiently. It is, however, still defective in several towns, but measures have been taken to ensure improvement. In 1884 the registered births numbered 108,725, or 41·3 per 1,000, as compared with 105,921, or 40·3, in 1883. In every district the birth-rates exceeded the death-rates, the excess varying from 14·2 per 1,000 in Akola to 19·3 in Buldana; the average for the province was 16·7 per 1,000.

The year 1884 was exceptionally healthy and had the effect of causing a considerable diminution in the death-rate. Coming after a year of great mortality this is a matter for congratulation. Deaths were registered to the number of 64,508, or 24·63 per 1,000, being 70,273, or 26·7, less than in 1883. Young children were again the chief sufferers, no less than 55·4 per cent. of the total mortality having occurred among those under five years of age. From all the chief diseases there were fewer deaths, a sure indication that the year, on the whole, was a healthy one.

It is satisfactory to note that cholera in an epidemic form was absent from the province during the year. Only 87 deaths were registered from the disease, against 27,897, or 10·60 per 1,000, in 1883, and these were confined to 19 villages in the districts of Ellichpur, Akola, and Buldana. In his remarks upon the various theories in regard to the cause and spread of cholera the Sanitary Commissioner says: "These "variations in the intensity of cholera outbreaks from year to year occur everywhere "throughout India, as may be seen from the Sanitary Reports of the various "provinces, and would indicate that something beyond the cholera bacillus, a con- "taminated water-supply, or human intercourse, is necessary to explain this difference "between the results of different years . . . . Whatever these conditions or "influences may be which originate and favour the spread of cholera, they still remain "to be discovered, or the cause explained why one season should be healthy and "another unhealthy. We know, however, that much can be done beforehand to ward "off the ravages of cholera when it does come, by attention to the sanitary condition "of our towns and villages, for experience has shown that as dirt invites and fosters "cholera, so, on the other hand, a good sanitary state greatly lessens the liability to "attack."

Deaths from small-pox also show a considerable decrease, the registered number for 1884 being 615, or 0·2 per 1,000, against 3,853, or 1·46, in 1883. The disease prevailed in every district and through each month of the year, but it was fatal only in 202 villages out of 5,501. Of the total deaths, 212 occurred among infants under one year of age, and 384 among children between one and ten years. Statistics show that the mortality from this disease has greatly diminished since vaccination was introduced and extended, "but the large death-rates at the younger ages show," the Army Sanitary Commission observe, "that it is not sufficient to have a high general "vaccination rate, unless it can be shown that the high rate is due to operations "performed in the first year of age."

Fever deaths were less numerous than the average for the previous five years and less by 23,044 than in 1883, the number registered in 1884 being 30,551, or 11·6 per 1,000, against 53,595, or 20·37, in 1883. According to districts, Wun, as usual, recorded the highest fever death-rate (15·8), and the minimum mortality (6·9) was registered in Basim. No explanation is given why these two districts should persistently return the highest and lowest fever death-rates. The Army Sanitary Commission suggest that the matter should be inquired into. "All that can be done with the case as it "stands," they remark, "is to point out the probability of local drainage defects "leading to local causes of malaria, as influencing the amount of fever."

Deaths registered under bowel complaints were 9,319, or 3·5 per 1,000, against 19,044, or 7·24 per 1,000, in 1883. There was the same diversity in the rates of the different districts as from fevers.

Assam.

Satisfactory progress was effected in the registration of births and deaths in Assam during 1884, especially in the latter, but the results are still far from accurate. Births were registered to the number of 120,483, or 26·61 per 1,000, against 108,269, or 23·91, in 1883. The ratio for the year under notice was made up of extremes varying from 19·38 per 1,000 in Lakhimpur district to 41·65 in Goalpara. The registered deaths numbered 132,992, or 29·37 per 1,000, against 122,932, or 27·14, in the previous year. In all districts but Cachar the deaths exceeded the births, the provincial excess amounting to 12,509, or 2·76 per 1,000. "It would hence appear," the Army Sanitary Commission remark, "that the registration of deaths is better done than that of births, and not "that the population has diminished." The results obtained in the tea gardens also indicate improvement in registration, the birth-rate having risen from 26·70 per 1,000 in 1883 to 31·66 in 1884, and the death-rate from 30·07 to 40·91. This, however, is a very high rate of mortality compared with that of the general population of the province, and is attributed to the coolies being almost entirely imported, and accordingly, subjected to climatic conditions, often differing considerably from those to which they have been accustomed in their native places. In the opinion of the Sanitary Commissioner, Dr. Eteson, the high mortality was partially due to preventable

causes. This subject, the Government of India state, should receive careful attention.

Nearly three-fourths of the excess mortality of the year was contributed by cholera, the disease having been unusually prevalent during 1884 and the death-rate the highest on record. The deaths from cholera numbered 22,276, or 4·92 per 1,000, against 14,908, or 3·29, in 1883. Every district suffered, but the disease prevailed with special severity in Nowgong district, which returned a cholera mortality of 8·95 per 1,000. The coolies in the tea gardens also suffered very severely from cholera, the death-rate (8·3 per 1,000) being nearly double the provincial rate. The tea planters ascribed this prevalence to newly imported batches of coolies, while at the same time they admitted that the coolies left the steamers in good health, that the disease was prevalent generally in the district, and that some time elapsed before the coolies became affected. "The "facts appear to show," the Army Sanitary Commission observe, "that there are "causes of some kind in the tea gardens themselves which predispose the coolies to "attacks of cholera during epidemic seasons, and we would suggest that rigid inquiry "should be made into the conservancy arrangements, water-supply, and drainage of "the localities where the workpeople live." The immigrant coolies on board river "steamers appear to have been remarkably exempt from cholera compared with the general population, the death-rate being 2·6 per 1,000, which was the lowest on record. This Dr. Eteson attributes to the improved arrangements at Dhubri depôt, to the avoidance of overcrowding on board the steamers, to the introduction of an accelerated service of mail steamers, whereby the voyage has been shortened from sixteen to four or five days, and to improved sanitary arrangements on board.

Small-pox was less prevalent than in 1883, the registered deaths having fallen from 6,162, or 1·37 per 1,000, to 4,781, or 1·05. Darrang and Cachar districts again recorded the highest death-rates, namely, 1·35 and 2·37, but both showed a decrease compared with the previous year. Of the total deaths no less than 3,365 were of children under 12 years of age. It is stated that the propagation of small-pox in Assam is largely due to the general practice of inoculation. Dr. Eteson, however, thinks that the statistics of the year furnish indications that vaccination is repelling the disease in some localities.

The mortality from fever was also less than in 1883, the number of deaths having decreased from 67,494, or 14·90 per 1,000 to 66,527, or 14·69. In the more populous districts the death-rates ranged from 8·81 per 1,000 in Lakhimpur to 38·03 in Goalpara; but in such a climate as Assam these figures, in the opinion of the Army Sanitary Commission, only show the state of the registration and not the fever prevalence. The high fever death-rate of Goalpara district is again attributed to the prevalence of the fever locally known as *kala azar*, described in Vol. XVII., p. 16. During the year under report the attention of the Chief Commissioner of the province was directed to the water-logged condition of tracts specially affected with sickness in this district, and measures were being taken to ascertain the facts by a professional survey. There was a marked absence of any connexion between the rainfall of the year and the prevalence of fever. The Army Sanitary Commission notice that "in Goalpara district, with a "rainfall of 65·25 inches, the fever death-rate averaged 38·03 per 1,000, while in "Sylhet, with a rainfall of 144·11 inches, the fever death-rate was 11·64 per 1,000, "affording a clear indication that the amount of fever depends on other factors than "the amount of rain." The Sanitary Commissioner states: "The body of registrars "name fever as a cause of death simply because there has been a symptomatic "increased temperature sensible to an ignorant observer. Nearly half the deaths of "the province are put down to fevers. Perhaps one-third of these are climatic or "malarial, and due to natural causes under which the people must live and die for "generations to come: a third is probably due to the habits of the people, their "insufficient clothing and bedding, their exposure, their food, and privations; and the "remaining one-third would, under a more perfect system of registration, be entered "under other classes of disease."

The number of deaths ascribed to bowel complaints was the largest on record, namely, 16,157, or 3·56 per 1,000, against 14,474, or 3·19, in 1883; but the Sanitary Commissioner considers registration under this head very imperfect, "which we must hope," the Army Sanitary Commission observe, "to be the truth of the matter, for the "year's statistics give a death-rate among the coolies from bowel complaints of 10 "per 1,000."

The results of the registration of births and deaths in British Burma for 1884 were again very unsatisfactory. A new system of collecting vital statistics was, however, British Burma.

introduced in some districts late in the year, and in others from the commencement of 1885, and better results are expected. Births were registered during 1884 to the number of 82,783, or 22·66 per 1,000, against 83,735, or 22·92, in 1883; and the loss to population by deaths amounted to 69,234, or 18·95, against 53,583, or 14·67 per 1,000. The imperfectness of registration is further shown in the very great difference between the urban mortality (36·65) and the rural mortality (16·61).

From all the chief diseases more deaths were registered than in the previous year. Cholera prevailed with great severity, and gave rise to 5,515 deaths, or 1·51 per 1,000, against 2,186, or 0·60, in 1883. The towns suffered more than the villages, the death-rate of the former being 2·68 per 1,000 and of the latter 1·36. But although the disease was very prevalent it was confined in area, for only 227 villages out of a total of 14,811 were affected. The general result of the year's experience, the Army Sanitary Commission remark, "may be said to be that, during cholera periods, two "factors are included, the epidemic, over which we have no control, and local insani-"tary conditions, which we can remove or mitigate. It is the same experience which "is reproduced in every outbreak of cholera, and it carries its lesson with it."

From small-pox 6,102 deaths were registered, equal to 1·67 per 1,000 of population, which was the largest number on record, and exceeded the mortality of the previous year by 5,427, or 1·49. The disease was most fatal among children, no less than 84 per cent. of the total deaths having occurred among children under 12 years of age; it prevailed, also, with greater severity in the towns than in the rural circles, for the former yielded the high death-rate of 4·86 per 1,000, while the ratio of the latter was 1·25.

To fevers were ascribed 29,514 deaths, or 8·08 per 1,000, against 26,283, or 7·19, in 1883. In discussing the influence of climate on fever, the Army Sanitary Commission compare the mortality in each of the four divisions of the province with the average rainfall of the year. "At first sight," they say, "it would appear that the more rain "the more fever was the rule in Burma; but this is really not so, and the causes of "fever mortality must be sought elsewhere. There are whole districts of country in "which the fever-rate is remarkably low, that is, if the registration could be depended "on, and it is not improbable that some of the mortality may be due to the usual "local insanitary conditions as well as to malaria."

Bowel complaints yielded 3,719 deaths, or 1·02 per 1,000, against 2,781, or 0·76, in 1883, and the entire mortality is reported to have been returned from 131 villages, less than one per cent. of the total number.

IV.—JAILS.

The health of the prison population of India during 1884 was, on the whole, more favourable than in the previous year. Sickness was somewhat more prevalent, the admissions into hospital having risen from 996 per 1,000 of average strength in 1883 to 1,025, and the daily sick rate from 36 to 37 per 1,000; but the mortality fell from 31·37 to 29·11, which is the lowest death-rate on record, and less by 7·13 per 1,000 than the average of the five years 1872–76, and 3·39 below the average of the years 1877–81. This satisfactory diminution in mortality, the Army Sanitary Commission observe, "has co-existed with reduction in the prison population, which means less crowding "and more ventilation." Sickness and mortality in 1884.

Dysentery and diarrhœa were the chief death causes, yielding 9·73 of the total death-rate; respiratory diseases and phthisis followed with 7·38 and fevers with 2·97 per 1,000. From cholera the death-rate was 1·43 per 1,000, against a previous 10 years' rate of 3·46. "This reduction in the midst of a severe cholera epidemic," the Army Sanitary Commission remark, "affords evidence of good work done in many "jails."

The following statement gives the leading facts in connexion with the health of the jails of the various provinces of India for 1884 as compared with 1883:—

Provinces.	1884. Ratio per 1,000 of Average Strength.			1883. Ratio per 1,000 of Average Strength.		
	Admissions.	Daily Sick.	Deaths.	Admissions.	Daily Sick.	Deaths.
Bengal	1,420	50	50·41	1,498	50	52·21
Madras	765	29	20·55	861	32	29·87
Bombay	702	26	34·91	734	27	34·33
Punjab	1,131	27	28·04	951	22	29·11
North-Western Provinces	681	26	20·86	563	23	18·76
Central Provinces	932	32	42·02	979	36	76·97
Berar	486	11	8·72	558	14	8·49
Assam	2,109	56	81·19	2,125	56	43·12
British Burma	936	37	30·28	1,159	39	28·94

The vital statistics of the prison population of Bengal were, on the whole, more favourable in 1884 than in the preceding year, and the death-rate was much below the average. The admissions into hospital were in the ratio of 1,420 per 1,000 against 1,498 in 1883, the daily sick rate was the same, 50, and the mortality 50·41, or nearly 2 per 1,000 less. Both in 1883 and in the year under report, much was done to improve the condition of the jails and of their inmates. There are, however, it is stated in the Government Resolution on the jail report, many predisposing causes to "sickness against which no measures taken by Government or the Inspector-General can "adequately provide without the help of careful and intelligent supervision by super-"intendents of jails. Now that so much has been done in the way of providing "improved accommodation, good water, ample food, and sufficient clothing for our "prisoners, Sir Rivers Thompson thinks that unremitting watchfulness and care on "the part of these officers will have more effect in reducing the sickness and mortality "than any further measures which the Government can adopt." Bengal.

Among the convict class the death-rate was 59·4 per 1,000 of average strength against 53 in 1883. These prisoners suffered chiefly from dysentery, diarrhœa, fever, general debility, and respiratory diseases. Cholera was not exceptionally prevalent, but accounted for 57 of the total 691 deaths, being in the ratio of 4·1 per 1,000 of average strength. Twenty-four jails out of 45 were quite exempt from the disease, while in the outside population it caused great havoc, and in 29 jails there were no cholera deaths. The jails which suffered most were Rajshahye (11 deaths), Gya (9), Monghyr (6), and Alipore (5).

Although showing an improvement on previous years, the Bengal jail death-rate still continues very high. To some extent this would appear to be due to the bad state of health of prisoners on admission. The Inspector-General reports that "there were "1,084 prisoners in jail awaiting trial on the 1st January 1884, and 28,830 were "received during the year. The daily average number in jail was 1,170, and each,

" on an average, was in jail only 14·86 days, and yet 49 died before their cases were " decided. These deaths can hardly have been due to any of the conditions of prison " life. However injurious they may be, they could hardly kill in 15 days." He further states that "out of 720 prisoners who died during the year only 274 were " considered on admission to be in good health, and 212 were positively bad."

Of the 45 jails in the province the following 18 recorded death-rates above the general average:—

Jails.	Death-rate per 1,000 of Average Strength.		Jails.	Death-rate per 1,000 of Average Strength.	
	1884.	1883.		1884.	1883.
Rungpore	283·4	196·9	Bhagulpore, *District*	71·5	45·0
Julpigoree	162·6	261·9	Balasore	70·1	—
Mymensingh	153·0	56·5	Monghyr	66·3	59·2
Bogra	134·5	148·0	Dacca	63·1	78·8
Purneah	115·3	37·8	Midnapore, *District and Central*	58·1	104·5
Rajshahye, *District and Central*	110·8	63·2	Furreedpore	57·6	31·2
Singbhoom	102·2	16·6	Backergunge	54·2	53·6
Burdwan	80·7	47·6	Nuddea	53·3	118·3
Dinagepore	79·7	107·6	Alipore	51·1	47·6

Regarding the high death-rate at Rungpore, the Inspector-General notices that it is based on a daily average population of only 230, and therefore every death which occurred represents more than 4 per 1,000. And in Singbhoom the death-rate is calculated on a daily average population of less than 75, and represents 9 deaths, each counting as 11 per 1,000. Of the first seven of the above jails, Rungpore, Julpigoree, and Bogra appeared in a similar list in the previous year. Out of 59 deaths at Rungpore 33 were due to bowel complaints and 5 to fever. At Julpigoree 10 out of the total 17 deaths were due to bowel complaints and 2 to cholera. Bowel complaints were also the principal death causes at Mymensingh, contributing no less than 33 of the total deaths; and the remaining four jails of the first seven suffered in a similar manner. It is again noticed in the Resolution of the Bengal Government on the Jail Report that the primary cause of the high rate of mortality in the jails of Eastern Bengal "is the diseased condition of the low class of people to which the prisoners " generally belong, and that no known preventable causes exist in the jails. Every " sanitary precaution has been and will continue to be taken for preserving the health " of the prisoners, and although this has not been hitherto always attended with " decided success, the Lieutenant-Governor still hopes that, with perseverance and by " utilizing the knowledge obtained from special inquiries, a real improvement is " gradually being effected in the health of the prisoners."

Madras.

The general health of the jail population in the Madras Presidency during 1884 was good. Among all classes of prisoners the death-rate was in the proportion of 20·55 per 1,000 of average strength against 29·87 in 1883. In eight jails out of 33 there were no deaths, but in seven, all being district jails, the mortality was still above 40 per 1,000. Although cholera was prevalent in all the southern districts of the Presidency, the only jails affected were Trichinopoly, Tanjore, and Cuddalore; altogether nine deaths were recorded from this disease. The highest death-rate from all causes was recorded at Tanjore jail (60·81), which had long been unhealthy; the construction of the new cellular jail was reported to be completed, and it was hoped that before long the old jail might be entirely evacuated. In Trichinopoly jail, which was the subject of a special inquiry in 1882, there was an immense improvement in the health of the convicts, the death-rate having declined from 176·77 in 1882 and 55·14 in 1883 to 23·21 in the year under review. This jail is now under the charge of a medical officer.

Among the convicts there were 149 deaths, equal to 20·70 per 1,000 of average strength against 29·49 in 1883. Bowel complaints contributed 36 to the total deaths amongst this class of prisoners, anæmia and general debility following with 26. From cholera there were only 7 deaths against 13 in the previous year.

In discussing the health statistics of the Madras jails (Appendix, p. 167), the Army Sanitary Commission notice the small mortality from epidemic disease as compared with that of the civil population. "Our object in introducing these comparisons," they say, "is simply to call attention to the fact that 7,000 inhabitants out of the population

" of the Presidency have had their sanitary surroundings so improved as to have nearly " escaped epidemics, showing that the work of improvement is a practical one, and to " raise the question why it is that the remainder of the population not in jails suffer so " greatly, and why so little effort has been made to improve their sanitary surroundings."

Bombay. The general health of the prison population of the Bombay Presidency during 1884 was also good, the ratio of admissions to hospital and of daily average sick being smaller than for many preceding years, while the death-rate showed a slight increase from 34·33 to 34·91 per 1,000 of average strength. This increase of mortality was chiefly due to the exceptionally high death-rate (107·9) at Nara district jail. On two occasions during the cold season of the year this jail, which was of a temporary structure and movable, was destroyed by fire, including all the warm clothing; consequently the prisoners were greatly exposed. The jail has since been reconstructed on a different principle, and various improvements connected with its re-organization and sanitary arrangements have been carried out, which it is hoped will lead to better results in the future. The total deaths in the district and central jails during the year numbered 249, all but one having occurred among the convict class. Of the chief death causes, respiratory diseases were more fatal than any other, the deaths numbering 58, or four more than in 1883; dysentery and diarrhœa followed with 50 against 43; while from fevers the deaths fell from 33 in 1883 to 26, and from cholera from 15 to 4. As usual, nearly half the deaths occurred among convicts in the first six months of their imprisonment. In almost all the jails of the Presidency the ratio of mortality showed very favourable results, excepting those in Sind province, which contributed more than a half of the total deaths.

Punjab. In the Punjab jails sickness was slightly more prevalent and more widely spread in 1884 than in the previous year; but it was of a less severe character, as shown by the decrease in mortality from 29·11 per 1,000 of average strength in 1883 to 28·04, a ratio which compares favourably with that of the free population during 1884, namely, 35 per 1,000. In 19 out of the total 36 jails, however, the mortality was greater than in 1883, the greatest increase being in the Delhi jail, where it rose from 24·39 per 1,000 of average strength to 74·41. On the other hand, there was a decrease of mortality in 16 jails, while in four there were no deaths. "The very low death-rate of the " Rawalpindi jail (10·17)," the Inspector-General reports, "is worthy of note. This " jail has, in former years, suffered from most destructive epidemics. Last year it " was one of the healthiest in the province, a result which, I believe, is in some measure " due to the efficient supervision of Surgeons-Major Massy and Bennett, who have " bestowed the greatest care on all arrangements that affect the health of the prisoners." All the jails which exhibited the greatest sickness and mortality lie between Lahore and Delhi, and were visited, it is reported, by one common epidemic of malarious fever, which was equally, sometimes to a greater extent, prevalent among the free population, and which was attributed to special climatic causes. The chief causes of mortality in the Punjab jails were respiratory diseases, chiefly pneumonia, from which there were 89 deaths, or 17 less than in 1883. From intermittent fever the admissions were nearly one-half more numerous than in 1883, but the deaths from it fell from 55 to 27; on the other hand, dysentery and diarrhœa caused 65 deaths, or 25 more than the number of the previous year. Deaths from anæmia and general debility also rose from 24 to 30; but both numbers are considered very small for the population, "a fact which " indicates a satisfactory state of health of the prisoners." There was very little cholera in the province during the year, and there were only two cases in the jails, neither of which proved fatal.

Among the convicts the deaths numbered 312, equal to 28·87 per 1,000 of average strength against 29·82 in 1883. Nearly a third of the deaths occurred among convicts who had been less than six months in jail.

North-Western Provinces and Oudh. There was more sickness among the prisoners of the North-Western Provinces and Oudh than in 1883, and there was also an increase in the proportion of deaths, though the death-rate, on the whole, continued low. The admissions into hospital among prisoners of all classes rose from 563 per 1,000 in 1883 to 681 in 1884, and the death-rate from 19·76 per 1,000 of average strength to 20·86. The increased mortality was entirely due to bowel complaints, from which the number of deaths amounted to 152, or 46 more than in 1883. Among individual jails the highest mortality was recorded at Banda, namely, 150 per 1,000, which was attributed to dysentery and other sequelæ of fever, the prisoners being predisposed to illness by the scorbutic taint which largely

prevailed in the preceding year. The Almora jail also returned a mortality of over 100 per 1,000 (102), and in nine other jails the death-rates exceeded 30 per 1,000. It is satisfactory to learn that "in a number of the jails that have had a reputation for "unhealthiness measures have been taken for the improvement of their sanitary "conditions by increasing the accommodation, removing obstacles to ventilation, and "arranging for a better water-supply; and these improvements will, it is hoped, "maintain the very creditable position that has for some time been held by the jails "of these provinces as the healthiest in India." Although cholera was generally prevalent in the province all the 52 jails but three were exempt from the disease. There were 13 cholera deaths, 11 of which occurred in the Meerut central prison, and one each at the Agra and Banda jails. Of the total 451 deaths from all causes all but 30 occurred among the convict class.

Central Provinces.

The vital statistics of the Central Provinces jails for 1884 show that, on the whole, the prisoners enjoyed better health than in the previous year. The number of admissions to hospital were much fewer, the daily average sick less, while the number of deaths (145) had decreased by nearly one-half the total of 1883. This reduced mortality was mainly due to the great decrease in the deaths under bowel complaints from 160 to 56. Another satisfactory feature was the entire exemption of the jails from cholera during the year, and their freedom also from small-pox and enteric fever. In 1883 the most unhealthy jail was Raipur, which recorded 112 deaths, or 145·0 per 1,000, but in the year under notice the mortality had decreased to 35, or 58·7 per 1,000. There were 138 deaths amongst the convicts, equal to 42·40 per 1,000 of average strength against 274, or 73·2, in 1883. Of the six jails in the province with an average population exceeding 100, Sambalpur jail recorded the highest convict mortality, namely, 62·18 per 1.000; but the greatest number of deaths took place in the three jails of Jubbulpore, Nagpur, and Raipur, together yielding 108 of the total 138 convict deaths. In these jails the average population exceeded 500.

Berar.

The health statistics of the Berar jails for 1884 compare favourably with the previous year, and "bear testimony," it is stated, "that the physical condition of the "prisoners is sufficiently attended to. They are further confirmed by the fact that "of the prisoners discharged during the year no less than 70 per cent. gained weight "during the period of their incarceration." The average daily sick-rate was remarkably low (11 per 1,000), and the general death-rate was only 8·72, identically the same as in 1883. There are six jails in the province, but the only two of any considerable size are the central jails of Amraoti and Akola. All the jails were free from death but Akola, where there were 9 deaths, equal to 20·2 per 1,000 of strength. The Inspector-General reports favourably of the general administration of the jails, and states that there was no overcrowding for any length of time in any of them.

Assam.

Sickness was more prevalent in the jails of Assam during 1884 than in any of the four years preceding, and there was a marked increase in mortality. Among all classes of prisoners the deaths were in the ratio of 61·19 per 1,000 of average strength against 43·12 in 1883. This excess was mainly due to an increased mortality from bowel complaints, respiratory diseases, and fevers. Cholera also was very prevalent, and caused 10 deaths, or 6·93, of the total mortality. The only jail in the province of any considerable size is Sylhet, with an average daily strength in 1884 of 517. Here the admission-rate (2,350) was very high, as was also the death-rate (70·8). Among convicts the admissions to hospital continued steadily to increase. Of an average daily strength of 1,328 of this class of prisoners the admission-rate was 2,300 per 1,000 against 2,102 in 1883, the daily average sick-rate 66 per 1,000 against 51, and the death rate 60·25 against 43·22. It is difficult to assign any cause for this increased mortality; it is stated "there were only 9 fatal cases of cholera (though "the disease was generally prevalent in the province), the same as in 1883. There "is nothing to show that the past year was a particularly unhealthy one; the only "conclusion, therefore, that the Officiating Chief Commissioner can come to is that "much of the mortality is due to accident."

British Burma.

The health of the jail population of British Burma in 1884 was not, on the whole, so good as in the previous year. The ratio of admissions to hospital was less, namely, 936 against 1,159 per 1,000, but the death-rate rose from 28·94 to 30·28. The total number of deaths in 1884 was 202 against 155 in 1883, the increase being mainly due to a larger number of deaths from anæmia and debility, small-pox, and bowel

complaints. There were in all 50 admissions from small-pox with 13 deaths, against two admissions and no deaths in the previous year. Of these 13 deaths 9 occurred among the convicts at Rangoon and 3 at Moulmein, the disease having been very prevalent during the year at both places. Cholera yielded 44 cases, of which 32 proved fatal, against 42 fatal cases in 1883; and it was present in five out of the 14 jails of the province. Two-thirds of the cholera deaths (22) occurred among the prisoners in the Akyab jail, or in the proportion of 52·76 per 1,000 of its average strength. This was the only serious epidemic, and the removal of half the prisoners to temporary quarters stopped it. As usual, the death-rate from all causes was highest among convicts recently admitted, and lowest among those who had been more than seven years in jail. An experiment was tried during the year of substituting pulse for fish in the rations of native prisoners two or three times a week, and so far as could be ascertained the change was attended with satisfactory results.

V.—VACCINATION.

General results.

The vaccination returns for the whole of India show a marked improvement on the previous year, though a large number of the population still remained unprotected. At the special vaccination establishments and dispensaries 4,770,118 successful vaccinations were performed among an estimated population of about 184 millions. Of these, 1,828,059 were children under one year of age, or less than a fourth of the estimated births. "This," the Army Sanitary Commission state, "is the only safe way of testing "the probable effect of vaccination, for whatever the number of vaccinations above one "year may amount to we have added year by year some millions of infants who are "the most susceptible subjects to attacks of small-pox, only one-fourth of the number "being protected."

Bengal.

Considerable progress was made in vaccination work in Bengal during 1884–85. With an increase of 147 officers to the staff the number of vaccinations rose from 1,364,642 in the previous year to 1,488,296, being an increase of 123,654. To this improvement all the circles, excepting Orissa and the municipal area, contributed. Of the total number of vaccinations, Government and licensed vaccinators performed 1,402,260, the rest by vaccinators attached to municipalities, dispensaries, &c. The increase, however, was entirely in primary cases, for secondary operations fell from 13,198 to 12,794; and of the 1,475,502 primary cases 99·38 per cent. were successful against a corresponding per-centage of 98·66 in 1883–84. By age children between one and six years of age were, as usual, the most largely protected, being at the rate of 66·74 per cent. of the total primary vaccinations; but the fact that the great majority of the small-pox deaths occurred among infants and children shows that much still remains to be done in protecting them by vaccination. Estimating the births within the vaccination area at 30 per 1,000 of population gives a total of 1,517,149, and out of this number only 211,480, or nearly 14 per cent., were protected. "The practical "result hence appears to be," the Army Sanitary Commission observe, "that, although "the total vaccinations do not fall very much short of the births within the vaccinated "area, they are so distributed among the ages as to afford little protection to the infant "population. This defect points to the necessity of an improved direction of the "work towards the ages under one year." Bovine lymph was largely used during the year, and, on the whole, was attended with satisfactory results. The Compulsory Vaccination Act was extended in the course of the year to several new police circles and towns, and the law is now in force in 81 towns, four cantonments, and nine rural areas; steps have also been taken to extend it to other municipalities.

The year's results also show a general improvement in inspection work, which was attributed to the close check kept over the proceedings of the different officers month after month during the year. Altogether 33,413 villages were inspected, and out of 1,397,500 vaccinations 1,124,377, being 191,182 above the number of the previous year, were examined. Of these 1,089,417 cases were found to have been successful.

As regards the attitude of the people towards vaccination, the Sanitary Commissioner says: "There is evidence in the Reports of the officers of the Vaccination "Department that vaccination is appreciated in many places, and that the ignorant "prejudices, mistrust, and opposition of former years are gradually giving way to a "healthier view of vaccination." And the Lieutenant-Governor in his Resolution on the Sanitary Commissioner's Report says: "Experience of the beneficial effects of "vaccination is slowly, but surely, popularizing it wherever it is introduced: it is a "work of time, and inoculation is still a powerful rival; but every year shows that "the superiority of vaccination is more generally acknowledged."

Madras.

Good progress was made in vaccination work in the Madras Presidency during 1884. The total number of operations performed was 803,469, or 49,880 more than in 1883; of these 773,118 were primary vaccinations with a ratio of success of 92·6 per cent. By far the largest number of cases were children between one and six years of age, namely, 375,687; while of infants under one year of age only 135,916 were successfully vaccinated, but this was an increase of 4,545 on the number of the previous year. Still the fact that only 19·5 per cent. of the surviving children born during 1884 were protected from small-pox shows how much remains to be done. "The remedy suggested by the year's experience is," the Army Sanitary Commission remark, "that the Madras "vaccination service should be directed to overtaking the births at ages under one

" year. But the great predisposition to small-pox epidemics in Madras Presidency " must be met by strenuous endeavours to improve the sanitary condition of the " population." Owing to the great prevalence of small-pox in Madras town vaccination was made compulsory there from the 23rd May 1884; and in order to give the people the necessary facilities for complying with the terms of the Act eight vaccine depôts were opened in various parts of the town, where the operations were performed. As regards the attitude of the people towards vaccination the Inspector of Vaccination in his Report for 1844 says: "There is still in some parts of the " Presidency a feeling against vaccination, although not so strong as it was. In some " parts a healthier view of vaccination is gaining ground, and people willingly come " forward to be vaccinated, especially when small-pox prevails. The cause of " vaccination has also progressed in places where the officials take personal interest in " pushing it on."

Bombay.

During 1884–85 there were 865,568 persons vaccinated in the Bombay Presidency, being a decrease of 18,271 on the number of the previous year. Primary operations numbered 802,207 against 826,965, and of these 764,445, or 95·29 per cent., were successful, being 0·40 per cent. below 1883–84. In the protection of infants the year's returns show a satisfactory improvement, 63·41 per cent. of the total number of infants under one year of age (reckoning the births at 31 per 1,000 of the population), having been successfully vaccinated as compared with 61 per cent. in the previous year. Except in Bombay City, where animal lymph only is used, and a few other places where both animal and human lymph were in use, vaccination in all other places was carried on with human lymph. In the work of inspection the vaccination staff made 4,546 encampments, travelled 87,076 miles in 8,063 days, and inspected 832,759 children in 12,709 villages; but only 38·44 per cent. of the total operations were inspected against 40·76 in the previous year.

The Compulsory Vaccination Acts in Bombay City and Karachi continue to work satisfactorily, and in both cities considerable progress was made in the protection of infants.

Punjab.

Owing to the excessive prevalence of fevers among the infantile population during the autumn months the vaccination returns for the Punjab for 1884–85 do not compare favourably with those of the previous year. The total operations numbered 583,498 against 633,062 in 1883–84, of which 567,711 and 624,873 respectively were primary cases. Of the primary vaccinations 94·78 per cent. were successful, a trifle better than in 1883–84. The number of infants successfully vaccinated was 406,858, little more than half of the 809,912 registered births of the year; and 92 per cent. of the primary vaccinations were among children under six years of age. In discussing the vaccination work of the year the Army Sanitary Commission notice that during the preceding five years the ratios of vaccinations to deaths were 20·30 and 1·14 per 1,000 respectively. And they say: "If the population continued to live for the next half century without " any addition by births, it would be by that time protected, and this merely shows " how inadequate the work done is to the emergency. We are glad to know that of " recent years the service has been greatly improved, and that the annual mortality " table already given (Appendix, p. 194) appears to show that good results have been " already attained. But the practical result of all the past experience appears to be " that, while the tendency of the disease to take on the epidemic character must be " met by improving the sanitary condition of the people and of the localities they " inhabit, the vaccination work must be more specially directed to protecting infantile " ages, when most good may be done in the way of warding off attacks of the disease " in after life."

North-Western Provinces and Oudh.

The vaccination returns for the North-Western Provinces and Oudh for 1884 show that 656,561 vaccinations were performed during the year, being an increase of 7,494 on 1883. The successful primary vaccinations, however, were not so numerous, numbering 563,864, or 87·94 per cent. of the total primary cases, against 565,351, or 92·10. Of the successful cases only 294,583 were under one year of age, being in the proportion of about 15 per cent. of the registered births. This diminution of successful operations was attributed to three causes: the prevalence of fever and small-pox, the supply of an inferior quality of lymph, and a want of energy on the part of the establishments, especially in Oudh, consequent on the introduction of the rule which retains them throughout the year in the districts in which they are employed. Steps were being taken for remedying this last cause, and the Government of India hoped that they would be carried out without loss of time.

In discussing the value of vaccination the Army Sanitary Commission point out that "in ordinary years lives are no doubt saved, and lower small-pox death-rates may be "co-existent with numerous operations. But this and similar experience appears to "show that the remedies, if such be available, will have to be extended beyond "vaccination, and will have to deal with epidemic causes, affecting localities and their "inhabitants. If sanitary work be neglected, no more dependence against small-pox "epidemics can be placed on vaccination than can be placed on quarantine against "invasions of cholera. The true remedies lie elsewhere altogether."

Central Provinces.

The returns of vaccination in the Central Provinces for 1884–85 show an increase in operations over the previous year of 5,683, the total number being 415,804 against 410,121 in 1883–84. Of these 400,455 were primary operations with a per-centage of success of 96·30, which is less by 0·89 than in the previous year. According to age 183,740 of the successful cases were infants under one year, being in the proportion of nearly 50 per cent. of the registered births, and 175,545 were children between one and under six years of age. The proportion of persons protected by vaccination during the year equalled about 38·27 per 1,000 of the population of the province. The work of inspection appears to have been creditably performed during the year, and it is satisfactory to learn that the attitude of the people has improved. Nowhere are the people hostile, though they are generally indifferent; but the people are reported to be not infrequently favourable to vaccination, and acknowledge the cordial and valuable assistance given by some of the vaccination staff. "There is little doubt," the Chief Commissioner observes, "that any difficulty still experienced may easily be overcome "by tact and patience."

Berar.

The statistics of vaccination in Berar for 1884–85 testify to continued improvement. The total number of operations performed by all establishments was 101,134, or 14,413 in excess of the number of the previous year. Almost all the year's work consisted of primary vaccinations, which numbered 100,970, and of these 95,895, or 94·9 per cent., were returned as successful against a per-centage of 92·6 in 1883–84. Of the total operations 93,517 were performed by the Vaccination Department, all but 82 being primary cases, and the per-centage of success was in the proportion of 95·3 against 92·9 in 1883–84. According to age the largest number of operations was performed upon infants, no less than 72·9 per cent. being children under one year of age. The per-centage of infants successfully vaccinated to estimated births at the rate of 40 per 1,000 of population rose from 53 in 1883–84 to 66·6, which was made up of ratios in the six districts ranging from 59·0 in Basim to 84·4 in Ellichpur. Considerable progress was also made in the work of supervision during the year, as 70 per cent. of the villages in which work was carried on and 56·2 per cent. of the total number of vaccinations were inspected by the superintendents. The per-centage of the season's work verified was highest in the Ellichpur district, where it reached 80·2, and lowest in Buldana, where only 41·1 per cent. of the total work was verified. "On the whole," the Superintendent of Vaccination, Dr. Little, states, "the work performed during "the year by all establishments was satisfactory; the conduct of the vaccinators "towards the people was, as a rule, kind and conciliatory, and complaints against "them were few. There was little opposition, except amongst certain castes, and "this is gradually diminishing."

Assam.

The results of vaccination in Assam for 1884–85 were satisfactory, showing a general advance and improvement. The total number of operations rose from 88,693 in 1883–84 to 103,731, showing an increase in 1884–85 of 15,038, which was spread over the entire province except in Sylhet and Cachar, where there was a falling off of 4,345 and 316 cases respectively. In the work done by tea agency there was also a decrease of 1,887 operations. Of the total vaccinations of the year 103,148 were primary cases, and of these 92,400, or 89·58 per cent. against 86·66 in 1883–84, were successful. There was, however, a marked difference in the work done by Government agency and that done by medical officers of tea gardens, that of the former having been attended with a success per-centage of 91·2 against 91·36 in 1883–84, and that of the latter of only 64·9. As previously stated the province on the whole during the year was remarkably exempt from small-pox, and there were indications that vaccination was repelling the disease in localities where the former had been systematically worked and its genuine protection adequately superintended. At the date of the Sanitary Commissioner's report small-pox was severely epidemic in the Khasi Hills, "and these foolish people," that officer states, "who last year threatened to disturb

" the public peace if the inoculators were prohibited, are now crying aloud for vacci-
" nation instead, and admit they have been led into their present trouble." The results of the year also show a satisfactory improvement in inspection work, the number of cases inspected having risen from 25,092, or 32 per cent. of the total operations in the previous year, to 42,534, or 41 per cent.

Throughout 1884–85 vaccination was carried on with greater success in British Burma than in the previous year, and several medical officers are reported to have taken a personal interest in, and to have worked hard for, the cause. The total number of persons vaccinated, including 744 dispensary cases, was 90,667, of which 83,518 were primary operations. The total operations performed by the vaccination staff were 89,923, a greater number than in the previous year by 16,654, which was accounted for by a new district (Salween) being for the first time brought under operation, and by a great increase in several other districts. The primary cases numbered 82,805 with a per-centage of success of 84·36, which was somewhat less than in 1883–84; but the average number of operations performed by each vaccinator was greater. The Sanitary Commissioner calculates that not more than one-tenth of the children born during the year were successfully vaccinated; " it is evident, therefore," as the Chief Commissioner remarks, " that there is still room for a very great extension of vaccination " operations." The Compulsory Vaccination Act was at the request of the Municipal Committees introduced into Rangoon and Akyab. British Burma.

VI.—MEDICAL INSTITUTIONS.

Civil Hospitals and Dispensaries.

Bengal.

There were 230 dispensaries at work in Bengal during 1884, of which five were chiefly supported by the State, 86 supported by local funds, 81 maintained at the cost of private individuals or associations, and 58 maintained by private subscriptions or guarantee, but receiving aid from Government or local funds. The total number of patients under treatment was 990,632, or 52,411 over the previous year. The Inspector-General attributed this increase mainly to greater care in recording entries, in consequence of more attentive inspections. "In the towns and villages," he says, "where "independent medical men have set up in private practice, we no longer look for the "attendance at our dispensaries of those who can afford to pay for medical advice and "medicines. In some situations the falling off of patients at our public charities "and the slow growth of attendance at others, are no criterion that there is any real "diminution in the benefits conferred on the sick poor, or that the European systems "of medicine and surgery are held in less esteem by the people; but may, with every "reason, be received as evidence of the fact that, whereas formerly, the better classes, "having no alternative, sought relief during illness at our public hospitals, now "engage for themselves and families the services of private practitioners. Indepen-"dent medical men have established themselves in practice throughout the country; "and while many are succeeding well, the majority may be said to be gaining a fair "and honourable livelihood by the exercise of their profession." Of the total number of patients, 25,077 were in-door patients, being more by 2,609 than in 1883. The number of this class of patients cured was 13,183, while 3,813 were relieved, 3,173 were otherwise discharged, and 3,701 died, the death-rate to total treated being 147·5 per 1,000 against 141·3 in 1883.

The health of the town of Calcutta during 1884 was very unfavourable, cholera and small-pox having prevailed with more than usual severity. At the six Calcutta hospitals the in-door patients increased from 20,381 in 1883 to 21,360; but, on the other hand, the out-door patients treated decreased from 239,337 to 235,685, which was attributed to "the establishment of chemists' shops throughout the town, to "which qualified surgeons are attached, who give advice and perform minor operations "free of charge."

The following table shows the number of patients under treatment in the several hospitals in Calcutta during 1884 and the previous year, and the mortality which occurred among the in-door patients:—

Medical Institutions.	1884.				1883.			
	Total Treated.			Died per 1,000 of treated.	Total Treated.			Died per 1,000 of treated.
	In-door.	Out-door.	Total.		In-door.	Out-door.	Total.	
Medical College Hospital	5,522	44,562	50,084	126·1*	5,541	51,022	56,563	112·08*
Presidency General Hospital	3,073	—	3,073	40·35	3,121	—	3,121	47·7
Mayo Hospital and Dispensary	2,451	181,274	183,725	159·52	2,212	176,619	178,831	164·5
Campbell Hospital	6,525	—	6,525	236·01	5,499	—	5,499	224·04
Police Hospital	2,221	—	2,221	10·8	2,377	—	2,377	11·7
Total Calcutta Hospitals	19,792	225,836	245,628	140·6	18,750	227,641	246,391	131·13
Howrah General Hospital	1,568	9,849	11,417	222·57	1,631	11,696	13,327	200·4
Grand Total	21,360	235,685	257,045	146·7	20,381	239,337	259,718	136·83

* Reckoned on the cases treated, exclusive of ophthalmic cases.

It will be seen from the above table that the death-rate was in excess of that of 1883 by nearly 10 per 1,000, the number of deaths having risen from 2,719 to 3,058. Of these, 536 were due to cholera and 86 to small-pox, against 510 and 35 respectively in 1883; but, exclusive of these two diseases, the year's returns showed an increase of 262 deaths, or 9·23 per cent. Dysentery also furnished a large mortality, but from all three diseases the per-centage of deaths to cases treated showed a decrease in severity. Chest diseases yielded a heavy mortality, and there is reason to believe, it is stated, "that a vitiated state of the air breathed was the principal cause rather than changes "in temperature." The number of important surgical operations performed during the year was 1,368, or 115 more than in 1883. Of these, cures were effected in 910 cases, in 139 relief was afforded, and death resulted in 99 cases. In minor

operations, numbering 18,737, there was an increase of 2,864 as compared with the previous year.

The system of nursing established at the Medical College and general hospitals under the superintendence of the ladies of the Clewer Sisterhood was reported on in the highest terms, and the Lieutenant-Governor of Bengal again recorded his recognition and high appreciation of the good work done by them.

Madras.

In the Madras Presidency the number of civil hospitals and dispensaries increased from 287 in 1883 to 299 in 1884, of which 87 were in charge of civil apothecaries. The eleemosynary education for the grade of civil apothecary was discontinued from 1st January 1885, and after June 1888 local bodies will have to find their own medical subordinates. The number of patients treated during the year was 1,753,898, against 1,696,809 in 1883, the increase, as usual, occurring chiefly among out-patients. There were 39,826 in-patients, or 1,379 more than in the previous year, of whom 3,100, or 77·8 per 1,000, died. This mortality was greater by 2·3 per 1,000 than that of 1883, and was chiefly attributable to the prevalence of cholera, which, as already stated, committed considerable ravages in the southern districts of Madras. The total cholera cases under treatment during the year at these institutions numbered 14,558, and the deaths 5,735. Of these, 748 cases and 425 deaths occurred among the in-patients, being in the ratio of 10·6 per 1,000 of their total strength. The year's work also witnesses to an increase in surgical operations from 49,180 in 1880 to 53,247. Major operations numbered 3,358, or 96 more than in the previous year, and of these 2,684 resulted in cure.

Bombay.

The total number of hospitals and dispensaries at work in the Bombay Presidency during 1884 was 208, or six more than in the previous year. Of these, 47 were maintained by provincial funds, 33 by local and municipal funds, 25 at the cost of private individuals or associations, while the rest were supported by private subscriptions, supplemented by grants from provincial or local funds. The number of patients treated rose from 1,372,249 in 1883 to 1,491,170, which was attributed partly to the increase in the number of institutions and partly to their extended popularity, for, as previously stated, the year 1884 in this Presidency was comparatively a healthy one. The increase of patients, however, was chiefly among the out-door class, for the in-patients increased only from 36,255 in 1883 to 36,402. Of these, 25,740 were cured, 3,611 were relieved, 3,565 were otherwise discharged, and 2,553 died, the ratio per 1,000 of deaths to total treated being 70, the same as in 1883. Malarious fever was, as usual, the disease by which far the largest number of patients (274,762) was treated. This disease was very prevalent during the year, and was no doubt partly answerable, it is stated, to the increase in the number of patients. Cholera cases fell from 6,215 in 1883 to 1,943, while small-pox cases rose from 845 to 1,099. The number of persons treated for venereal diseases of all kinds was 33,181, or 110 more than in the previous year. Major operations to the number of 4,182 were performed during 1884, of which 3,651 were discharged as cured, and 172 died. Minor operations numbered 76,546, being an increase of 1,124 on 1883. The minor operations, the Surgeon-General states, "continue to increase year by year, and "although individually they are of little importance, yet collectively they represent "the relief, temporary or permanent, from much physical suffering."

Punjab.

Six new dispensaries were opened in the Punjab during 1884 and one branch dispensary at Peshawar was closed, leaving 196 in operation; these included one State hospital, 194 dispensaries guaranteed or maintained by local funds, and one maintained partly at the cost of private individuals. The total number of patients treated was 1,781,939, showing the large increase of 183,683 over the previous year, which was partly due to the opening of new dispensaries, but mainly to the great unhealthiness of the year. In-door patients numbered 39,300, being an increase of 1,284 on the number for 1883, and among them there were 1,938 deaths, or 49·3 per 1,000, against 2,041 or 53·7. The principal diseases under treatment were malarial fevers, ophthalmia, respiratory affections, and ulcers. The first of these shows an increase of 99,770 cases (369,024 against 269,254) over the previous year, and ophthalmia an increase of 17,100. The number of persons seeking treatment for this latter disease is steadily increasing year by year. In 1881 the cases numbered 90,820 and in 1884 they had reached 132,307. No cause for this increase has yet been definitely assigned, but it is probable, it is reported, that the growing popularity of the dispensaries has something to do with the increased number of cases treated. Respiratory affections

rose from 128,954 in 1883 to 137,222. Cases of small-pox also increased from 245 to 366, while cholera cases declined from 113 to 94. The number of major operations performed in the course of the year amounted to 8,313, exceeding the number of 1883 by 1,667. In obstetric cases there was an increase of 139 on the figures of 1883 (893 against 254). It appears that steps were being taken "to effect the substitution of "trained nurses for the present ignorant and inefficient dhai, whose malpractices are "the cause of considerable loss of infant life and protracted suffering, and not "infrequently death to the mother." It is reported that in some places there was an overcrowding of in-patients, especially at Delhi, where the inadequacy of the existing hospital had long been felt. Steps were being taken towards providing the city with a more suitable hospital; subscriptions amounting to about Rs. 70,000 were collected, Government had promised a grant-in-aid of Rs. 10,000, and Rs. 50,000 had been promised from municipal and district funds, and it was anticipated that other assets would bring the total building fund to about two lakhs of rupees. Since the close of the year a suitable site has been selected for the new hospital.

North-Western Provinces and Oudh.

The statistics of the hospitals and dispensaries in the North-Western Provinces and Oudh for 1884 bear evidence of the fact that the year was an unhealthy one. During the year 236 institutions were at work, three of which were new ones. Of these, two were State supported, 202 were maintained by provincial and local funds, 21 were under private management, and 11 were chiefly supported by private individuals, but aided partly by State funds. Where possible arrangements were being made to have female patients and children prescribed for separately from the males. Complete statistics were received only from 214 institutions, against 212 in 1883, and at these the number of patients treated was 1,737,782 against 1,567,456 in the previous year, showing an increase in 1884 of 170,326. Of the total cases, 16·72 per cent. were under treatment for fever, 4·80 for dysentery and diarrhœa, 17·86 for skin diseases, 6·74 for respiratory diseases, and 5·50 for ophthalmia. The in-patients numbered 44,201, being more by 1,917 than in 1883, and among them there were 2,832 deaths, or 64 per 1,000 of the total number, against 2,549, or 60 per 1,000, in the previous year. Satisfactory progress continued to be made in the performance of surgical operations, which, it is reported, "has induced a widespread belief in the efficiency of modern surgery, and "has done much to attract patients to the hospitals." Minor operations rose from 78,403 in 1883 to 79,529, and major operations from 12,472 to 14,938, the latter number being nearly double that of 1881. The success of the operations was also very marked, for out of the total major operations, 11,143 were returned as cured, 1,973 as relieved, and 281 cases resulted in death against a corresponding mortality in 1883 of 296. Success is further indicated in the fact that of 6,366 patients operated on for cataract 4,592 gained good sight. It appears that the increased control which has been given to local boards over the medical institutions within their jurisdiction has not yet been productive of much practical change in any of the details of management; still in several districts some members were showing their interest in the dispensaries by giving them substantial aid and support.

Central Provinces.

There were 82 dispensaries at work in the Central Provinces during 1884, the same number as in the previous year. The management of those within municipal limits has recently been transferred to municipal committees, while all are practically maintained by local funds. The patients under treatment numbered 652,620 against 611,541 in 1883. This shows an increase in 1884 of 41,079 cases, which, however, was entirely among out-patients, for in-patients decreased from 7,545 in the preceding year to 6,961; and this decrease was "almost wholly due to a more careful observance "of the rules regulating admissions." Of the total cases, fevers, catarrhs, and rheumatic affections were more numerous than in 1883, which was attributed to the unusually heavy rainfall of the year; on the other hand, there was a decrease under bowel complaints. The number of deaths among the in-patients fell from 824, or 109·2 per 1,000, in 1883 to 624 or 89·6. The total number of operations performed in the course of the year was 18,341, of which 637 were of the major class as compared with 564 in 1883. There appears to be no doubt that the institutions are greatly appreciated by the people, though their popularity depends to a great extent on the hospital assistant in charge. "A popular hospital assistant means a crowded dispensary."

arar.

There were 42 medical institutions in operation in Berar during 1884, or one more than in the previous year. At these the total number of patients treated was 206,184, of whom 1,800 were in-patients, against 2,137 in 1883, and 204,384 were out-patients, against 193,227. The year being a healthy one accounted for the decrease in

attendance amongst in-patients. "But that there was no large decrease over the "figures of the previous year, which was pre-eminently an unhealthy one, may be "taken," Dr. Little, Inspector-General of Dispensaries, says, "as good evidence that "the people appreciate the dispensaries, and readily avail themselves of the means of "relief placed within their reach." Malarious fevers caused the largest number of admissions, being in the ratio of 20·4 per cent. of the total treated. Next in order of prevalence was ophthalmia (9·3 per cent.). "This affection," Dr. Little writes, "is most rife in the hot weather, due to irritation from the glare and to the impalpable "dust blown about at this season, which may contain, in a desiccated state, septic or "other irritant and putrid matter derived from a filthy village site." Next in order came skin diseases, with a ratio of 8·1 per cent. Most of the other diseases retained the same relative proportions as in previous years, excepting dysentery and diarrhœa, the cases of which were less, owing to the absence of cholera in an epidemic form in the province during the year. Of the in-patients, 1,567, or 87 per cent., were cured, 43, or 2·3 per cent., were relieved, and 66, or 3·6 per cent., died. The number of operations performed was 299 major and 7,328 minor, against 291 and 7,069 respectively in 1883. Of the major operations, which consisted chiefly in the setting of fractures, 267 ended in cure, 6 in relief, and 8 in death.

Assam.

Ten new dispensaries were opened in Assam during 1884, including one in the *kala azar* district of Goalpara, making a total of 39; and the number of patients was 107,136, or 29,576 more than in the previous year. This great increase was mainly due to the opening of the new institutions, but the attendance at the old ones increased by 11 per cent. As usual, more patients were treated for malarious fevers than for any other disease, namely, 16,935, or 3,711 more than in 1883; cholera cases rose from 599 to 1,614, owing to the increased intensity of the disease throughout the province; and small-pox cases numbered 121, against 68 in 1883. Skin diseases were very common, 14·9 per cent. of the total being treated under this head. In-door patients numbered 3,565, as compared with 3,294 in 1883, and among them there were 758 deaths, or 212·6 per 1,000, against 666, or 202·2, in the previous year. Both in major and minor operations there was an increase, the former amounting to 190, or 42 in excess of the number of 1883, and the latter 2,779 against 2,324. Of the major operations, 144 were cured, 13 partially relieved, and 16 died. "The disinclination of the Assamese to submit "to operations," it is stated, "owing to constitutional timidity, is a hindrance to "any rapid advance in this subject; but there is reason to believe that this aversion is "being gradually lessened, and that the prejudices and superstitions of the inhabitants "are being overcome by practical demonstrations of the utility of surgical measures." The Officiating Chief Commissioner states that much has been done of late years in administering dispensary relief and in improving generally the sanitary condition of the principal towns of the province, and he has no doubt that as the resources of the province and of the local boards increase improvement will continue.

British Burma.

In British Burma 31 dispensaries were in operation during 1884, three of which were new ones. The total number of patients treated was 169,741, or an increase of 18,668 over 1883. This increase, however, was almost entirely among out-patients, for in-patients, who numbered 13,574, were only 142 more than in the previous year. The most important causes of sickness were fevers, which were in the proportion of 16·57 per cent. of the total; skin diseases and injuries came next, with per-centages of 6·61 and 6·31, followed by respiratory diseases with 5·16. Deaths among the in-patients rose from 1,197, or nearly 90 per 1,000, in 1883 to 1,596, or over 117 per 1,000, in 1884. There was a marked rise in minor operations from 3,863 in 1883 to 4,201, but the number of major operations declined from 329 to 249; and of these latter, 202 ended in cure, 12 in relief, and 21 in death. It is stated that since these charities have come under the management of town committees, the people are not so ready to give pecuniary aid; but the institutions are on the whole popular, and receive constant supervision from the committees.

Lock Hospitals.

Bengal.

It was noticed in the report for 1883–84 that on the suspension of the Contagious Diseases Act in Calcutta the lock hospitals at Alipore and Sealdah were to be maintained as purely voluntary institutions. The returns of these hospitals for 1884 show a nominal decrease in cases of primary syphilis compared with the previous year, but the total was otherwise much greater than in any year since 1869. As

regards the effect which the withdrawal of the Act has had on the police force, the number of cases of venereal disease has increased from 1·46 per cent. of total strength in 1882 to 2·97 in 1884; and the men are reported to have suffered during the year from the most malignant types of the disease,—"a thing unknown in previous years." The effect on the garrison troops of Fort William was much more marked, the per-centage of venereal complaints on the mean daily strength having increased from 14·5 in 1882, and 28·0 in 1883, to 58·4; while the per-centage of cases of primary syphilis rose from 10·9 in 1883 to 30·24 in 1884, the highest ratio recorded in any year since 1870. Among the general population, venereal cases in the Calcutta hospitals and dispensaries were a trifle less than in 1883, namely, 10,020 against 10,147 in 1884; but still 1,246 in excess of the number of 1882.

Of the four cantonment lock hospitals in Bengal, the results obtained at Dinapore and Darjeeling show a considerable increase in cases compared with 1883, the admission-rates having risen from 145·16 and 27·14 respectively, in that year, to 265·21 and 170·12. On the other hand, there was a decrease in the admission-rates at Barrackpore from 268·2 in 1883 to 146·2, and at Dum Dum from 369·59 to 264·3. The cost of working the system in these four cantonments was, it is stated, considerably higher in 1884 than in the previous year, "and the fact remains that, notwithstanding "the powers which the police can exercise under the law, unlicensed prostitution "prevails almost as extensively as if there was no law or attempt at control."

Madras. The Contagious Diseases Act is reported to have worked smoothly during the year in Madras city. Out of 17,436 examinations 365 women, or a little over 2 per cent., were found diseased, "a result which shows that the class of registered prostitutes "was remarkably free from disease."

The average number of registered women at the seven military lock hospitals in the Madras Presidency during 1884 was 684, against 667 in 1883, and amongst them the number treated and the average daily sick was above the average, but the type of disease was much about the same. The number treated was 2,911 against 2,611 in the previous year, and the daily average sick rose from 159 to 171. The admissions for primary syphilis, the most serious of venereal diseases, were, however, considerably less than in the four preceding years. The rate of admissions from all forms of venereal disease amongst British troops was 272·12 per 1,000 of average strength against 274·24 in 1883. In five stations out of seven there was an increase, and in two a decrease in the admission-rates, the highest being 330·32 at Wellington. As in the case of the registered prostitutes there was a satisfactory decrease in admissions for primary syphilis amongst the troops. In his report for 1884 the Surgeon-General, of Her Majesty's forces gives a table showing the admissions for primary syphilis and gonorrhœa during the five years ending 1884 in the several stations where lock hospitals are established as contrasted with the admissions under the same headings where there are no lock hospitals. At the seven stations where lock hospitals exist the ratios of admissions per 1,000 of strength for the five years were, primary syphilis 112·70 and gonorrhœa 116·68; and at five stations where there are no lock hospitals the ratios were 50·19 and 76·80 respectively. "We are forced to admit by "a perusal of the figures," the Surgeon-General states, "that lock hospitals have "hitherto been kept up for the propagation of venereal amongst British soldiers, "though originally established with a very different intention. The greater prevalence "of venereal in stations where lock hospitals are established can be satisfactorily "accounted for. A registered woman rarely leaves the bazaar to ply her trade; in "many stations there is a place assigned to her in the bazaar and there she must "live. She is generally a prostitute from her earliest years; whereas the unregistered "woman is generally a villager, driven to prostitution for a livelihood, and she may "lie in wait for the soldier anywhere so long as she is not found out. She is invariably "diseased. In stations where there are lock hospitals she has no rival, as those "women, such as parcherry servants, grass-cutters, &c., who prostitute themselves "to supplement their wages are afraid to be seen out at night for fear of seizure and "compulsory registration. In the cantonments where there are no lock hospitals, "women can prostitute themselves when inclined without fear, and the health of the "soldier benefits by the rivalry which is so severely checked where lock hospitals are "established." This view, however, it must be observed, is by no means supported by the results in Bombay stations (see below).

Bombay. In Bombay City the Contagious Diseases Act is said to have worked satisfactorily during 1884. Disease was discovered in 3·8 per cent. of 12,361 examinations. As, however, 9·8 per cent. of the new registrations were found diseased, it is pretty clear

that among those who had been for any time under supervision its prevalence was but slight. "It is a noticeable fact," it is reported, "and one indicative of the value "of the Act that the 25,000 sailors who visit the port annually enjoy an almost entire "immunity from syphilis during their stay in Bombay. This circumstance is "doubtless due to the custom of this class of men to resort to licensed houses, whereas "the soldier, resident for some time in the place, has opportunities for forming "clandestine acquaintances, from which most of the contagion arises."

Lock hospitals were maintained at the same 12 stations in the Bombay Presidency as in previous years; but since the 1st of March 1885 those at Neemuch, Mhow, and Ahmedabad have been closed as an experiment. The average admission-rate for primary syphilis and gonorrhœa among the troops at stations with lock hospitals was 198 per 1,000, against 138 in 1883, and for stations with no lock hospitals, 377 per 1,000, against 278.

North-Western Provinces and Oudh.

As in the previous year 18 lock hospitals were in operation during 1884 in the North-Western Provinces and Oudh. The hospital at Moradabad, however, was open for only five months, and no detailed statistics of the working of the institution were received. Excluding this station the results compared favourably with previous years, the total admissions of soldiers to hospital from venereal diseases having fallen from 2,704, or 235 per 1,000 of strength in 1883, to 2,550, or 224 per 1,000, in 1884. The highest ratio was 327 per 1,000 at Meerut, and the lowest 122 at Chakrata. At Allahabad, Meerut, Roorkee, Naina Tal, and Jhansi, the protection afforded to the garrison against disease was more ineffectual than in previous years, but all other stations showed an improvement. The recorded statistics of the ten years in which the lock hospital system has been in force do not, it is stated, witness to any satisfactory results, for only in 5 out of 18 cantonments have the rules conduced to a substantial diminution in the ratio of venereal disease.

The daily average number of registered women declined from 979 in 1883 to 792, the decrease being attributable not altogether to the difficulty in obtaining women, but partly to the action of the Government in discountenancing expenditure on lock hospitals. With the decrease in the number of women there was a corresponding fall in the admissions to hospital, but the ratio of cases per woman rose from 2·35 to 2·57. This increase in the proportion of disease was confined, however, to disease of a minor description.

From the beginning of 1885 the lock hospitals at Allahabad, Meerut, Cawnpore, and Chakrata were by order of the Government of India closed.

Central Provinces.

The average number of women on the registers of the four lock hospitals in the Central Provinces during 1884 was 155, or two less than in the previous year, and the number of cases of admission into hospital among them from venereal disease was 319, or one more than in 1883. Among the troops the highest admission-rate was recorded at Jubbulpore, namely, 405 per 1,000 of average strength, against 261 in the previous year. This increase the medical officer attributed in a great measure "to the "number of women who practice prostitution in Jubbulpore; and although the city is "placed out of bounds for the troops, still they may gain access without attracting "notice, there being many inlets. For a short period during 1884 the restriction "against the troops visiting the city was withdrawn. The venereal diseases "increased, and the city was again placed out of bounds." The next highest ratio was 235 per 1,000 at Pachmarhi against 54 in 1883; but the comparatively small number of troops at this station (the average strength for the year being 123) makes the increase seem disproportionately large. At Kamptee there was an increase from 125 per 1,000 to 179, and at Saugor a decrease from 293 per 1,000 to 188. "The returns generally bear out the view so often expressed," the Chief Commissioner of the provinces states, "that the lock hospital system affords a limited protection, which "is beneficial so far as it goes. If the rules are at any time relaxed, the number "of patients in hospital is speedily increased, but even the best vigilance cannot "procure entire immunity."

British Burma.

Five lock hospitals were in operation in British Burma throughout 1884, three, viz., Rangoon, Thayetmyo, and Toungoo, being maintained and regulated by rules made under the Cantonment Act, 1880, for the protection of the troops; while at Akyab and Bassein hospitals were maintained by the desire and at the expense of the municipal committees of these towns chiefly for the benefit of the floating seafaring population. The lock hospital at Moulmein, which belonged to this class, was closed on the 1st June 1884.

As regards the protection afforded by the lock hospitals to European troops stationed in the province during 1884, it appears that although the average strength was reduced from 1,880 in 1883 to 1,628, the cases of venereal disease among the soldiers was 317, the same as in the previous year, the ratio per 1,000 of strength being 176·86, a higher ratio than in any of the preceding five years, and over 8 per 1,000 in excess of 1883. The increase was common to all three stations, but especially to Toungoo, where the ratio has been steadily increasing since 1880.

The average number of registered prostitutes at the six hospitals was 620, against 658 in 1883, and among them there were 956 cases of disease, or 272 less than in the previous year. In every hospital the per-centage of cases of disease to the average number of women on the register was less in 1884 than in 1883.

The admissions for venereal diseases in the dispensaries at the above six towns rose from 3,114 in 1883 to 3,380 in the year under review, and were one-third more than they were in 1879, a result "which would seem to imply," the Sanitary Commissioner observes, "that, like the military, the general population derive little or no "benefit from registered prostitution." The Chief Commissioner has directed that the authorities to whom is entrusted the working of the system should make more strenuous efforts to prevent the rules from becoming a dead letter.

Lunatic Asylums.

Bengal.

The number of persons treated for insanity in the five asylums in Bengal during 1884 was 1,139, exceeding that of the previous year by 58. Of these 208 were primary admissions and 24 were re-admissions, against 209 and 23 respectively in 1883. The cause of insanity was known only in 582 cases, 448 having been due to physical and 134 to moral causes. Recovery was effected in 90 cases, being at the rate of 9·77 per cent. on the mean daily population. This is a low rate of recoveries compared with 12·47, the average of the previous 10 years. Undoubtedly, the Inspector-General of Hospitals states, the longer chronic cases are kept in the asylums, the lower the per-centage of recoveries, while a certain number of criminal lunatics is a fixed quantity, and that these facts together tend to vitiate statistics. The health of the asylums was not so good as in 1883, the number of admissions to hospital having increased from 235 to 365, and the deaths from 52 to 87, the increase being principally occasioned by diarrhœa, dysentery, debility, and phthisis. "It is not a high mortality," the Inspector-General writes, "and could we but eliminate those deaths which right-"fully belong to 1883, the rate would be an average one. The healthy year 1883 "possibly prolonged the lives of the phthisical, the debilitated and senile lives, which "depend in a great degree, some altogether, upon meteorological conditions. Thus, "in 1883 2 deaths were placed to debility, 2 to old age, and 13 to phthisis; the "corresponding numbers for 1884 being 7, 4, and 26." Cholera was present only in the Dacca Asylum, where 3 cases were reported, 2 of which ended fatally.

Of criminal lunatics, 445 were under treatment against 423 in 1883; the fresh admissions numbered 86, or 19 less than in the previous year; the discharges rose from 50 to 61, and the deaths from 14 to 21, leaving 363 still in the asylums at the end of the year.

In the European Asylum at Bhowanipore 54 patients were under treatment, 25 of whom were admitted during the year, against 24 in 1883. In the course of the year 3 were discharged cured, 11 were sent to Europe under the Merchant Shipping Act, or otherwise, 4 were transferred to their friends, and 2 died, one being a case of decay in a hard drinker, and the other of acute mania in a woman.

Madras.

Each year witnesses to an increase in the number of lunatics to be accommodated in the three asylums of the Madras Presidency. The number treated in 1884–85 was 707, of which 214 were new admissions. Of these 91 were discharged cured, 33 were transferred to the care of friends, 8 were discharged otherwise, and 35 died, leaving 544 under treatment at the end of the year, or 51 more than the number remaining in the previous year. The death and sick rates continued to be satisfactory, though the former rose from 50·5 per 1,000 of average daily strength in 1883–84 to 67·1; but, taking into consideration the proportions of former years, the results of 1884–85 are looked upon as very satisfactory. Of criminal lunatics, there were 132 under treatment during the year, 30 of whom were fresh admissions. The working of the asylums continued satisfactory, and great improvements were made to the industries of the Madras and Calicut asylums by the addition in the former of printing, carpet making, carpentry, and blacksmiths' work, and in the latter of weaving, coir-rope making, fibre spinning, tailoring, &c.

As in previous years, there was a want of accommodation during 1884 in four out of the five lunatic asylums in the Bombay Presidency, the exception being Hyderabad, in Sind. The new asylum at Ratnagiri was still in course of construction, but it was expected to be ready for use in 1885. The total number of lunatics under treatment during the year was 920, as compared with 948 in 1883, of whom 315 were fresh admissions. The number discharged was 199, 61 as cured; and the deaths numbered 59, or 20 less than in the previous year. The general health of the patients was satisfactory, and there was no epidemic in any of the asylums. Ague, diarrhœa, dysentery, epilepsy, and debility were the diseases from which the patients chiefly suffered. Among the total 920 patients, the causes of insanity were known in 442 cases, being physical in 338, and moral in 104; excess in the use of intoxicating drugs was credited with 210 cases. Of criminal lunatics there were 116 confined against 107 in 1883; of these 16 were discharged before the close of the year, and 6 died. All the asylums, with the exception of that at Hyderabad, were inspected by the Surgeon-General with the Government of Bombay (Dr. Beatty), and he reported that they were conducted in an able and efficient manner. Bombay.

In the course of 1884, there were 497 lunatics under treatment in the two asylums (Delhi and Lahore) of the Punjab, 127 of whom were admitted during the year. Of these, 51 were cured, 19 were made over to their friends, and 41 died. The Superintendent of the Lahore Asylum reported that the year 1884 was as healthy as the preceding one, without epidemic disease, and that the number of deaths (23) was the same; but at the Delhi Asylum it was the most unhealthy year since 1878, and the deaths rose from 8 in 1883 to 18, the heaviest mortality being from pneumonia. The number of criminal lunatics treated in both asylums was 58. The Lahore Asylum being in need of an improved water-supply, arrangements have been made with the railway authorities for a supply of water brought by a pipe from their main to the asylum, and the work was being carried out. This asylum was also in much need of a ward for European lunatics, and it is satisfactory to learn that a new ward was completed during the year, and ready for occupation; six additional cells for violent lunatics were also completed. Punjab.

Since 1879, there has been a steady increase in the population of the four lunatic asylums of the North-Western Provinces and Oudh. In 1884 the total number under treatment was 1,279 against 1,205 in 1883, the fresh cases being 364. Before the close of the year 213 had been discharged or made over to their friends, 5 had escaped, and 85 had died, leaving 976 still in the asylums. The mortality was again highest at Lucknow, namely, 116·9 per 1,000 of average strength; Agra followed with a death-rate of 113·3, and Bareilly and Benares with 69·4 and 1·90 respectively. Of criminal lunatics, 261 were confined during the year, 61 being new admissions. The daily average strength of this class of lunatics rose from 196 in 1883 to 206, the increase being due to the extra caution that was exercised during the year in regard to their release when reported to have recovered. New wards at Agra for criminal lunatics were completed, and deficiency in accommodation was thereby remedied. North-Western Provinces and Oudh.

The total number of lunatics under treatment at the two asylums of Nagpur and Jubbulpore in the Central Provinces during 1884 was 321, of whom 71 were fresh cases, 30 being transfers from the Amraoti Asylum in Berar, which was closed by order of the Government of India. At Nagpur the lunatics numbered 174 against 129 in 1883, the increase being due chiefly to the transfer to this asylum of the 30 lunatics from Berar; and at Jubbulpore the number was 147, less than in the previous year by 21. At the close of the year there still remained 286 inmates in the asylums, 13 having passed out as cured, 3 being transferred to their friends, 9 otherwise discharged, and 10 having died, the same mortality as in the previous year. Of the deaths, Nagpur contributed 6 or 45·3 per 1,000 of daily average strength against 4 or 35·3 in 1883, and Jubbulpore 4 or 29·9 against 6 or 58·8. As in other asylums in India dysentery and diarrhœa were the chief causes of death. As regards the inmates of the Nagpur Asylum, the Superintendent states: "The general health, apart from mental disease, "has been good. This may fairly be due to the favourable conditions under which "they live, and under these come housing, clothing, feeding, conditions of labour, site "of asylum, and so forth. Every lunatic is weighed once a month in my presence, "and his or her then condition recorded; disease of an insidious nature must thus "come to light." The Jubbulpore asylum was also reported to have been very healthy during the year. No particular kind of sickness was prevalent. Central Provinces.

Assam. The Tezpur Lunatic Asylum in Assam had 67 patients under treatment on the 1st January 1884; and during the year 21 new cases were admitted, making a total of 88, or 5 less than in 1883. Of the 21 new admissions only 6 were natives of the province, the majority of the patients being natives of Bengal. In the course of the year 15 patients were discharged as cured, 7 were made over to friends, and 8 died. The medical history of the asylum, although not so favourable as formerly, showed an improvement on the results of 1883, the number of deaths having declined from 14 to 8. The asylum was visited in 1883 by a severe cholera epidemic, which resulted in 9 deaths; the disease reappeared on the 24th June 1884, and 5 cases occurred up to the 26th, when the attacks ceased. Of the 5 cases 1 terminated fatally. Besides cholera there were 7 deaths from general disease, viz., 3 from phthisis, and 4 from general debility and dysentery, which brings the total mortality to 135 per 1,000 of population, and to 380 per 1,000 of admissions into hospital. The Superintendent of the asylum attributed the great mortality to the impoverished condition of the inmates at the time of the admission. "These are grave records," the Sanitary Commissioner states. "Much is to be urged in respect of the bad "health in which so many inmates are received, and also that with so limited a popu- "lation fluctuation of rates will often be extreme; but the total of 66 deaths on 243 "admissions, since the asylum was opened eight years ago, gives the high figure of "271 per 1,000 . . . . The statistics of daily sickness in the asylum certainly "bear out the contentions that the extraordinary mortality is not caused by want "of proper care, food, clothing, &c. within the precincts. An admission rate of "1,486 per 1,000 and a daily average sick of 22 per 1,000 cannot be considered "excessive among a population who may be considered primarily diseased as a body; "and the type of ailment from which the lunatics suffer is only that of the ordinary "population."

British Burma. During 1884 there were 60 fresh admissions to the Rangoon Lunatic Asylum, British Burma, which, added to the 190 patients remaining at the close of 1883 gives a total of 250. In the course of the year 44 were discharged, 25 as cured, and 15 with improved mental health, and 23 died. Of the total treated 42·4 per cent. were suffering from acute mania, and 23·2 per cent. from melancholia. The daily average sick and mortality, namely, 10·66 and 23 respectively, were exceptionally high, the increase in the latter from 12 in the previous year being chiefly due to the hopeless condition in which several patients were admitted. The mortality as calculated on the daily average strength was 127 per 1,000 against 63·5 in 1883; but "the majority of those who died," the Superintendent reports, "had been for years in bad health, kept alive by "nourishing food and careful nursing, so that their deaths were expected; the greater "number of these having succumbed this year, we may look for less mortality in 1885." The employment of the patients was continued with success, and was more extended and varied in character than in the previous year.

Medical Schools.

Bengal. The total number of medical students reading in the medical schools of Bengal increased from 722 in 1883–84 to 804 in 1884–85, and the monthly roll number from 741 to 847. In the Calcutta Medical College, the session opened with 117 students; 14 students of previous years rejoined the classes and there were 86 new admissions, making a total of 217 students against 197 in the preceding year. At the close of the session 14 students passed their final L.M.S. and M.B. examinations, 29 hospital apprentices passed and left for regimental duties, while 2 senior and 4 junior scholars, 29 paying and 7 free students, ceased to attend. At the close of the session there were therefore 132 students on the rolls. For the first M.B. and L.M.S. examinations of the University of Calcutta, 16 candidates passed out of 36. For the second M.B. and L.M.S. examinations, 14 passed out of 25 candidates; two Native dhais and eight pupil nurses passed in midwifery. The results of the examinations at the four vernacular Medical Schools were also very favourable. At the Campbell Medical School, Sealdah, the number of students rose from 190 in 1883–84 to 207, of whom 87 were fresh admissions. All the third and fourth year students, numbering 56, passed the final license examination. At the Dacca Medical School 31 students passed the final examination and received their diplomas as civil hospital assistants. Sixteen students at the Temple Medical School, Bankipore, obtained their diplomas. And at the Cuttack Medical School 11 candidates went up for the final examination and all passed, obtaining licenses qualifying them for third class hospital assistants, or to become ordinary Native medical practitioners.

The Dacca Homœopathic School which was opened in 1882–83 had become very popular, so much so that a second institution was established in 1884–85, when the two schools had 168 pupils. After a three years' course the pupils are considered qualified to practice, and may expect to earn from Rs. 30 to Rs. 50 a month.

Madras.

With the close of the year 1884–85 the Madras Medical College completed the first half century of its existence. The strength of the institution at the beginning of the year was 215, including 12 female students, against 182, of whom 10 were females, in 1883–84. Of these, 120 males and 4 females were in the senior department, and 76 males and 7 females in the junior department, besides 7 casual students. It is worthy of note that one of the female students was in the Chemist and Druggist class. From the Senior department 59 candidates went up for the University examinations, when 15 failed. As a proof of the progress made by the college, it may be mentioned that about 96 students were to appear for these examinations in 1885. The fact also that three students succeeded in passing the M.A. examination, two in biology and one in physical science, is considered a further proof of the soundness of the instruction imparted in this college.

In the second department or Apothecary class, 36 students, including three females, appeared for the first or primary examination, and all passed except two apprentices and one female student. Three hospital apprentices and three female students appeared for their final examination, and all passed.

All the lady students are reported to have made creditable progress during the year.

Bombay.

In the Grant Medical College there were 370 students on the rolls during 1884–85, of whom 17 were females. The class for female students was only instituted in the previous year, and of the 12 who then formed the class, 10 continued their studies, and 7 others were admitted, one being an undergraduate. In the course of the year the curriculum was revised so as to allow of the students having two courses instead of one in all the more important junior subjects.

The number of male students rose from 238 in 1883–84 to 353; but the results of the examination were not so favourable as in the previous year. For the L.M.S. degree 38 students appeared, the same number as in 1883–84, and only 23 passed, 3 in the first and 20 in the second division, as against 5 and 23 respectively in the previous year. At the first examination there were 81 candidates, 20 only being successful, whereas in 1883–84 43 succeeded out of 93 candidates. Two candidates appeared for the M.D. degree, and one succeeded in obtaining the coveted distinction; 5 assistant surgeons were found qualified for promotion; and from the military pupils' class 8 fully instructed apprentices passed out as qualified for the grade of sub-assistant apothecary. In reviewing the events of the year, the Principal of the college draws particular attention to the large increase of numbers of matriculated students, who for the past five years had averaged 266, whilst in 1868 they numbered only 20. He also notices that the college is taxed almost beyond its strength to meet the demands on its teaching capacity, and he looks forward to the day when a college of experimental science, with laboratories fitted for scientific experiment and research, shall be found in Bombay.

The medical schools at Poona, Ahmedabad, and Hyderabad continued to progress. The attendance at Poona was slightly less than in the previous year, but at the other two it was greater. The results of the examinations were also satisfactory. Twenty-two students from Poona, and 13 from Ahmedabad passed their final examination, against 16 and 15 respectively in 1883–84; and for the first time the Hyderabad Medical School submitted its pupils to the test of the final examination. The pupils of this school consist of native medical pupils and High School pupils, and the object in view is to provide the province of Sind with qualified practitioners, as well as to recruit the local subordinate medical service with suitable candidates. Eight of each class of pupils passed the final examination.

North-Western Provinces and Oudh.

The Agra Medical School during 1884–5 was attended by 111 students, whose progress on the whole appears to have been satisfactory. In the senior class all but five of the 28 pupils passed their final examination. In the second class, composed of 34 pupils, three of whom were females, there was an improvement in the number of students who passed at this stage, the first of the final examinations. The female students of this class, who were all Native Christians, did not turn out so well as was hoped, but they were encouraged to persevere and complete the school course. In

both these classes the military sections were reported to be inferior to the civil. The third class consisted of 21 civil and private pupils, who during the previous year had been attached for practical instruction to a dispensary. The fourth or junior class contained 31 pupils, 8 of whom were females. There were only 15 civil pupils in this class, and, as a body, they were reported to be inferior to those admitted in the two preceding years. The prevalence of cholera at the time of the entrance examination is reported to be the cause for the deficiency in numbers and the inferiority in general attainments of the candidates selected from a smaller field. The most notable feature of the administration of this school during the last few years has been the formation in 1882–83 of a class for female students. At first only Native Christians joined, but the fact that candidates in fair numbers, amongst whom were Hindus and Muhammadans, were coming forward, bids fair to the ultimate success of the scheme.

VII.—SANITATION.

Civil.

During 1884 much attention was paid by the Government of Bengal to the sanitary condition of Calcutta and its suburbs, and steps were taken with the view of remedying existing evils. As noticed in the Report for last year (1883–84) a Commission was appointed by the Lieutenant-Governor to enquire into and report on the adequacy or otherwise of the provisions made by the Municipal Commissioners for the cleansing and conservancy of the town. An exhaustive inquiry was made, and the Commission submitted a valuable report, with their recommendations for various improvements. Bengal.

The supply of filtered water to Calcutta was considerably increased during 1884–85, the average daily supply being 8,207,330 against 7,975,960 gallons in the previous year; there was also an increase in the house connections from 15,187 to 15,830. Since 1879 the supply has increased about 11 per cent., while the house connections have increased upwards of 31 per cent. The sewerage of the town was almost completed, and considerable progress was made in the structural improvement and subsoil drainage of bustees. With reference to the improvement effected in the drainage of bustee lands, the Health Officer states: "One steady object has been held in view "throughout the year, viz., to confine sewage in surface drains of masonry falling "into the sewers, and to prevent as far as possible its escape over the surface." Good progress was made in improving privies and latrines. The work of tank and well filling and the substitution of bathing platforms was pushed on with energy, as was also the surface conservancy of bustees. Much attention was paid to the improvement of cowsheds and cattlesheds, and good work was done in structural improvements of streets.

The income of the Municipalities of Bengal, excluding Calcutta, for the year 1884 amounted to about 320,000*l.* against 336,000*l.* in the previous year. Notwithstanding this diminution the apportionment for sanitary works was raised from 34 per cent. in 1883 to 38 per cent., the increase being spread over all heads except conservancy establishment and water-supply. The most important work of the year under water-supply was the completion of the Burdwan works, a measure which is reported "to be of "great benefit to the inhabitants of the northern part of the town, in which pipes "have been laid and hydrants set up." At first many of the inhabitants were unwilling to use the filtered supply, but opposition soon died away, and 99 per cent. of them were using it. In Dacca further improvements were made in the filter beds, and the munificent Nawab Assanoollah had, in commemoration of the visit to India of their Royal Highnesses the Duke and Duchess of Connaught, extended the waterworks northward. This has proved a great boon to a crowded locality. With reference to this work the Army Sanitary Commission remark: "India at present affords abundance "of opportunities for men of wealth and influence to bestow similar benefits on their "poorer fellow subjects. The example is one which should be commended and "followed." The works in connection with the water-supply of Bhagulpore town were being carried on, and Government has lent the services of the Superintending Engineer and his subordinates for the undertaking free of cost. Arrangements were made for the preparation of plans and estimates of an approved scheme of water-supply for Howrah, in which other river-side towns were to join. In Nuddea district improvement of the water-supply was under inquiry with the object of ascertaining, if possible, to what extent the prevalence of malarial fever and other zymotic diseases there was due to bad water.

During the year many drainage schemes were prepared, and some, where funds would admit, were sanctioned. Further improvements to the drainage of the fever-stricken district of Nuddea were effected. The drainage works of Moorshedabad city which were commenced in 1883 were completed, and further improvements were under consideration. Steps were being taken to improve the drainage of Raniganj town in Burdwan. The question of radically improving the drainage of Patna municipality was under consideration, and in defect of means for a general drainage scheme provision has been made for keeping the rainfall from stagnating by a system of surface pucca drains; these works are reported to have proved of the greatest service.

Little appears to have been done to improve the sanitation of villages. A suggestion was made by the magistrate of Shahabad to the effect that Government

might take special sanitary action in its villages; this suggestion the Government of India considered worthy of consideration, and the Army Sanitary Commission stated that if the course were followed, "health and life would be saved, and an example set "forth that the Government meant what it advocated to be carried into action." Amongst the miscellaneous sanitary operations of the year, the chief event was the passing of the new Bengal Municipal Act III. of 1884, which contains excellent sanitary regulations relating to sewage and other matters. Another important Act calculated to benefit sanitation, the Bengal Local Self-Government Act, was passed in April 1884, and has since received the sanction of the Supreme Government.

Madras.

The water-supply of the town of Madras was seriously affected in November 1884 by a cyclone which completely breached the Red Hills Reservoir, causing the loss of the whole store of water. A supply was, however, obtained from another source, the Koratur tank, till February 1885, when a temporary bund at Red Hills was erected, and the water was raised above the level of the off-take pipes, and the town was again supplied. Advantage was taken of the low level of the water in the lake to commence the off-take tower, which is a part of the new water-supply scheme, in the deepest part of the tank, and the work was vigorously pushed on. Extensions of the existing water-supply were carried out in other parts of the town. The Black Town drainage scheme was making progress, and the pumping station at Royapuram was formally opened on 30th June 1884. The surface drainage of the eastern portion of Black Town between Popham's Broadway and the sea was almost completed, more than 70,000 feet of surface drain having been laid down in the 15 months ending March 1885. In the diversion of drains from the Coum Canal, a plot of land in Poodoopett, over 22 acres in extent, was purchased, and, a parcherry being removed from it, was levelled to serve as a sewage farm for the disposal of the contents of a large drain which flows into the Coum.

In other parts of the Madras Presidency the sanitary work of the year 1884 consisted chiefly in the repairing and cleansing of tanks and wells, in the repair and construction of latrines, drains, roads, &c., and in improving village sites. In the municipalities, excluding Madras town, the sanitary allotment was about 65,000*l.*, or 33·9 per cent. of their estimated income, against 57,000*l.*, or 33·2 per cent. in 1883–84; but of this allotment only about 38,000*l.* were utilized at the end of the year. A similar state of things occurred in the local fund circles, where out of the sanitary grant of about 37,000*l.*, equal to 26·5 per cent. of their aggregate available income (one-third land cess), only 19,000*l.* were expended up to the end of December 1884. Steps, however, have been taken by the Government to impress upon the various authorities the necessity of utilising the whole of the sanitary allotments during the year for which they are sanctioned, and better results are expected in the future. An Act was passed during the year (the Madras Local Boards Act, 1884) which "provides "for the prohibition and removal of obstructions, and the cleansing of tanks, streams, "wells, and unwholesome buildings and lands in all rural areas," and under its powers the Sanitary Commissioner expects that greater attention will be paid to town and village sanitation. "But the great want in all villages," the Army Sanitary Commission point out, "is cleansing and keeping clean, provision of suitable accom- "modation for cattle to enable them to be removed from compounds and houses, and "providing village water supplies;" and these important points they hope will not be overlooked.

Bombay.

Various sanitary improvements were completed during the year in Bombay Municipality. The construction of the catchment channels on the slopes above the Vehar and Tulsi lakes, and the raising of the Tulsi dams were brought to a close; the Bhandarwada Reservoir and the filter beds at the Malabar Hill Reservoir were completed, and the latter were in use nearly the whole year. The roofing of the latter reservoir, and the laying of a new main, from Behar to the outlying portions of the island, were also in progress, and the Municipal Commissioner believes that when these works are completed the quantity and quality of the water distributed over the city will be as ample and as perfect as it is possible to make them with the present sources of supply. Since the close of the year the Corporation have sanctioned the construction of an additional artificial lake at Tansa, and, when the project is carried out, "the difficult "question of water-supply to the present city of Bombay and to any possible future

"Bombay will be set at rest finally and for ever." A number of waste water meters were fixed during the year, and much waste was thereby prevented.

In the drainage of the city considerable progress was made during the year under review in the construction of main sewers. The laying of the pipe sewers in the first section of the drainage scheme was completed, but owing to the want of house connexions these sewers were practically useless. The surface drainage to carry off the storm waters, which often flood the low-lying parts of the town, was nearly completed, but during the rains the sewage of the city is still carried in these drains, the result being a serious nuisance on part of the flats. His Excellency the Governor in Council therefore trusted that the connexion of the sources of sewage with the new main drains, which is necessary for the abatement of this nuisance, would be completed without avoidable delay. He further hoped that the inhabitants of Bombay would realise the soundness of the opinion that the value of a thorough system of drainage is second only to that of a copious and pure supply of water.

No sanitary work of any magnitude was undertaken in any other part of the Bombay Presidency during 1884, but a good deal was done in improving the general sanitary condition of localities. Out of an income of 298,667*l.* the municipalities, excluding the city of Bombay, expended 66,081*l.* on conservancy.

In the local fund circles sanitary work consisted chiefly in providing and repairing of wells, on which about 13,000*l.* was spent. At the suggestion of the Sanitary Commissioner, a Consulting Sanitary Engineer (Colonel Ducat, R.E.) for the Presidency, was appointed during the year, and municipalities were informed that his services would be placed at the disposal of such as might desire them for the preparation and execution of designs for sanitary works on their undertaking to pay his salary and allowances during the period he might be so employed. The municipalities of Ahmedabad and Hyderabad in Sind have already applied to Government for his services, the former in connexion with water-supply and sewerage, and the latter city, which has a good water-supply, for a sewerage scheme. The Army Sanitary Commission have no doubt that, if the services of this officer are made use of by municipalities, much public good will follow.

The Sanitary Commissioner, Deputy Surgeon-General Hewlett, testifies to the satisfactory work of the civil surgeons, who during the year visited 102 towns and 4 villages, and made many valuable suggestions which he hoped would lead to the improvement of sanitation of towns and villages in the vicinity of the large towns and cantonments.

An important memorandum has since been drawn up by the Sanitary Commissioner for the information and guidance of village patels throughout the Presidency for the purpose of showing them what the several insanitary conditions which obtain in villages are, and how they should be remedied; and also to instruct them in what cases they can, when authorised, put in force the powers conferred on them by existing law. The Governor of Bombay trusts that the circulation of this "highly "valuable memorandum, and the explanation of its provisions at high schools and "colleges, will contribute to enlighten the public on subjects of vital importance, and "stimulate co-operative and private initiative. Insanitary conditions of houses are a "serious evil, but it would be impossible to enforce legislation throwing expenditure "on individuals who could not afford it. Education and the influence of good "example will bring about the desired results in accordance with the necessarily slow "process of assimilation of scientific requirements."

Punjab.

Amongst the more important sanitary works executed or undertaken during the year in the Punjab, may be mentioned the Sanjauli Reservoir at Simla, calculated to hold 2,000,000 gallons, which was so far advanced at the end of the year that water could be stored in it. There is another reservoir capable of storing 1,180,000 gallons; together these two will give an aggregate supply of 4½ gallons a head to 16,000 people. A portion of the drainage of this hill sanitarium was also commenced, at an estimated cost of 11,000*l.* At Amritsar the drainage works for the removal of storm water from the city and suburbs, and for the drainage of certain jhils near the civil lines, were drawing to completion. At Delhi schemes for water-supply and drainage were prepared and submitted to Government; the former was approved at an estimated cost of about 100,000*l.*, but the drainage project, amounting to 40,000*l.*, was still under consideration. In the suburbs of Delhi drainage works were restored at a cost of 1,500*l.* At Peshawar the Bárá river, which runs through the city, was cleansed and converted from a filthy channel into a comparatively clear stream, fit for watering streets, &c.; a scheme for supplying the city with pure water was also under considera-

tion. Plans and estimates for the drainage of Hoshiarpur were waiting the sanction of Government, and the project for a circular drain for the city of Sialkot was sanctioned. Besides the above, a great number of minor improvements in connexion with conservancy, water-supply, drainage, &c., were carried out in the municipalities at an expenditure of 92,000*l.*, equal to about 32 per cent. of their income. In the course of the year the Sanitary Commissioner did a large amount of useful inspection work, when he advised the members of the newly-elected boards under the Local Self Government Act on the sanitary improvements needed, on the utility of the practice of vaccination, and on matters of domestic and personal hygiene.

North-Western Provinces and Oudh.

"With few exceptions no sanitary work of any magnitude was executed during the year in the North-Western Provinces and Oudh, the funds at the disposal of municipalities being, as a rule, it is stated, barely sufficient to meet absolutely necessary expenditure for the repairs of roads and drains, and other minor work; but almost all the municipalities appear to have devoted a portion of their income to sanitation. At Bareilly 2,600*l.* was expended on works, chiefly in connexion with the drainage of the city. At Saharanpur a loan of 5,000*l.* was applied for to carry out a complete drainage scheme for the city. In Azamgarh and Gorakhpur also important drainage operations were being carried on. At Lucknow the water-supply scheme, prepared in 1883, was completed, and the question of experimental artesian borings was under the consideration of the Government. Good inspection work was done during the year by the Sanitary Commissioner, who found that "works of sanitary improvement continued "to be effected in almost every centre of population; and I have reason to think the "increasing powers and the authority of the municipal and local authorities, is "resulting in increased attention to and more effectual performance of those works, "so important to the welfare of the people." The Government of India in their orders on the Sanitary Commissioner's report state that "no important steps appear to "have been taken to improve the sanitary condition of villages in any district." The subject has since been brought to the notice of district officers and they have been requested to endeavour to induce villagers to adopt some simple rules of sanitation.

Central Provinces.

There is little to record under the head of sanitary improvements in the Central Provinces. The work of the year was of minor importance, consisting chiefly in cleaning tanks, wells, and drains, repairing and constructing latrines, &c. During the year the Sanitary Commissioner inspected several towns and a considerable number of villages with reference to the village conservancy rules recently passed by the Chief Commissioner; and he found that in some sanitary measures were already being attended to. The Army Sanitary Commission testify to the importance of these rules, which, "if obeyed continuously," they say, "will remove many disease causes;" and they express concurrence in the summing up of this matter by the Chief Commissioner of the Province, who is quite aware that much has to be done in improving the sanitation of towns and villages. He has insisted, when necessary, on municipal committees doing their duty in this matter, and he will not permit this duty to be neglected. But he also realises that much good work has been done, and he is convinced that to have such work carefully ascertained and acknowledged does much to encourage those who are engaged in it. "In regard to village sanitation, energy must "be accompanied with patience, but greater progress may, no doubt, be looked for "now that we have responsible mukaddams in every village, and that the agency of "local boards can be made use of."

Berar.

The expenditure incurred on sanitary improvements in the municipalities of Berar during 1884 amounted to 15,700*l.*, the principal items being conservancy, drainage, and water-supply. Besides this outlay, several important permanent sanitary works were being carried out. The two large schemes for providing the towns of Amraoti and Khamgaon with a good supply of water were approaching completion. The Kalapani tank, to supply the town of Amraoti with water by means of pipes, at an estimated cost of 30,000*l.*, has been completed, and arrangements were being made for taking the water into private houses. The municipalities of other towns were seriously considering the question of their water-supply, and it was hoped that in the case of Akola and Ellichpur, where schemes for considerable extension and improvement of their present supply are feasible, it would be found possible shortly to undertake them. With regard to village sanitation, the Sanitary Commissioner states

that since the introduction of the rules promulgated by the Resident in 1880 "con-
" siderable improvement has undoubtedly been effected, and where these rules are
" observed the village site is clean and the surroundings undefiled . . . . The minds
" of the people are gradually becoming familiarised with the fact that what is required
" under these rules is for their own benefit, and no opportunity is lost of impressing
" this upon them, and that it is not merely for a whim of their rulers that these simple
" sanitary precautions are enforced." Steps were being taken for the supply of Dr. Cuningham's Sanitary Primer, as a class book, to all schools.

Assam.

Little appears to have been done in the way of sanitary improvement in the province of Assam during 1884. For all purposes the expenditure was 6,900*l.*, of which amount only a sixth part was devoted to drainage and water-supply. The only works calling for notice are the Gauhati water works, which were still in progress, and the Goalpara drainage scheme, the main channels of which have been already completed and at work for two years. The latter undertaking has been placed in the hands of the local board with a view to its more speedy completion. Although the record of sanitary improvements is small, there appears to be every desire to forward improvements if means were available. The Army Sanitary Commission, however, think "that more activity in the localities themselves in forwarding the work, even
" with the means at disposal, might very well be shown. The people should learn
" that in small places whatever is required for protecting health ought to be done
" by the people themselves, and that, if they do not choose this course of action, they
" must pay somebody else to do the work. This ought to be the duty of every
" municipal government."

British Burma.

No sanitary works of any magnitude were undertaken in British Burma in 1884; but some important projects were under consideration. At Rangoon an elaborate scheme for the drainage of the town at an estimated cost of 170,346*l.*, or with a supplementary high pressure water-supply at 180,035*l.*, was under consideration. At Prome a sum of 12,428*l.* was spent in the course of the year on the new water-supply works which were practically complete. At Pegu a general scheme of surface drainage was commenced at an estimated cost of 2,500*l.* In most of the other municipalities works of minor importance were carried out, and town committees generally were evincing much interest in the sanitation of their towns. Nothing, however, appears to have been done to improve the sanitary condition of the villages in the province, but the Chief Commissioner's attention has been directed to the matter by the Government of India. The total amount expended by the municipalities during the year on sanitary work was 15,149*l.*, but of this sum 8,454*l.* were allotted to markets and burial grounds, leaving less than 7,000*l.* for sanitary work properly so-called.

Military.

Bengal.

The total expenditure on military works in the Bengal Command during 1884–85 was 575,003*l.*, against 673,532*l.* in the previous year. This is the only information given by the Sanitary Commissioner with the Government of India, owing to the details of works executed or in hand not being available at the time of the publication of his report.

Madras.

The Surgeon General of Her Majesty's forces in Madras, in his report for 1884, gives an account of the sanitary condition of the stations. The account, the Army Sanitary Commission state, "does not call for remark, as there seems every disposition
" to render the barracks and stations healthy, and indeed the low death and inefficiency
" rates of 1884 show how much good work has been done." Nevertheless, as they point out, there are some few cases in which improvement is much needed; but these, it is satisfactory to learn, were under the consideration of the authorities.

Bombay.

The expenditure incurred on military sanitary works in the Bombay Presidency during 1884 amounted to 9,888*l.*, against 17,473*l.* in 1883. Large sums were expended on improvements in the cantonments at Ahmedabad, Nasirabad, and Aden, while in several other cantonments minor works were carried out. In discussing the sanitary condition of the cantonments, as described in the report of the Surgeon General of the Bombay troops, the Army Sanitary Commission remark that there is evidence in the report "that the chief elements in the sanitary state of the stations are becoming
" better understood, and their importance to the health of the troops duly appreciated.

"Much good work has been done, with a corresponding saving of life and efficiency, "which is not shown in the statistics, because data are included which belong to the "Command as a whole, and the data regarding Quetta and the troops on march in "Southern Afghanistan have to be discussed for practical purposes as a separate "problem." The excessive sickness and mortality among the troops stationed at Quetta during 1884 have already been noticed. In consequence of the unhealthiness of this station the Sanitary Commissioner of Bombay, Deputy Surgeon Hewlett, paid a visit to the district in February 1885, with the view of reporting on the sanitary condition of the cantonment. He submitted a report containing several important recommendations, which are now under the consideration of the Government of India.

W. T. Benson.

India Office,
October 1886.

ABSTRACT

OF

SANITARY AND OTHER REPORTS

FOR

1884.

ABSTRACT OF REPORT OF THE SANITARY COMMISSIONER WITH THE GOVERNMENT OF INDIA FOR 1884.

(DR. B. SIMPSON.)

European Troops.

The health of the European troops during the year 1884 was not so favourable as it had been during the previous year, but the health statistics for 1883 were unusually favourable. Sickness and mortality in 1884.

Abstract of Statistics of European Troops in India for the last seven years 1878 to 1884, and for the ten-year period 1870–79.

Year.	Strength.	Ratio per 1,000 of Strength.				
		Admissions.	Daily Sick.	Deaths.	Invaliding.	Total Loss.
1870–79	577,416	1,475	60	19·34	43	62
1878	56,475	1,651	68	21·46	45	66
1879*	49,582	1,977	78	24·28	49†	73†
1880*	51,796	1,789	74	24·85	26†	51†
1881‡	58,728	1,605	70	16·86	38	55
1882	57,269	1,446	65	12·67	33‡	45
1883	55,525	1,336	63	10·88	33	44
1884	54,996	1,513	67	12·56	32	44

* Excluding troops serving in Afghanistan. † Including troops in Afghanistan.
‡ Calculated on the strength obtained from Annual Returns.

The admission-rate for the year under review, 1,513 per 1,000, was above the average of 1870–79, a period for the most part undisturbed by military operations on a large scale. The daily average sick ratio, 67 per 1,000, was correspondingly increased. Notwithstanding this increased incidence of sickness, it is satisfactory to find the total death-rate, 12·56 per 1,000, considerably below the average of the last ten-year period. The mortality was 1·68 per 1,000 greater than that of 1883, which is the lowest on record. The loss to the army by invaliding was nearly 1 per 1,000 less than it was during 1883, the total loss to the army from death and invaliding being 44 per 1,000, the same as it was during 1883, or 18 per 1,000 less than the average loss during 1870–79.

The same may be said generally of the health of the British troops of the Bengal Presidency. Sickness was more prevalent than it was during 1883, as is evidenced by the increased admission and daily sick ratios. The admission-ratio, 1,662 per 1,000 of an average strength of 33,486, is greater than the average ratio during 1870–79, but is less than the average of the preceding 10 years (1860–69), which was 1,755 per 1,000. The daily sick ratio, 70, exceeds the averages of both decennial periods. The mortality from all causes equalled 11·68 per 1,000, a ratio almost identical with the very favourable result of the preceding year, which was the lowest on record. Loss by invaliding, 32 per 1,000, was somewhat greater than it had been during the preceding year, but less than the average loss from this cause in 1870–79 by 9 per 1,000. The total loss to the army from death and invaliding was 44, or 18 per 1,000 less than the average of the ten-year period.

The health of the British troops of the Madras Presidency was more favourable than in either of the other two Presidencies. The admission-rate, 1,109 per 1,000 of an average strength of 10,785, was greater than the ratio of the previous year, but below the ten-year average of 1870–79. The daily sick ratio, 57, was less than usual. The total mortality was remarkably low, viz., 8·53: this ratio is the lowest on record for the Madras Army. Cholera was but little prevalent, and occasioned a mortality of 0·93 only. The loss by invaliding (32 per 1,000) was 17 per 1,000 less than the average of 1870–79, and the total loss by death and invaliding, namely, 40 per 1,000, was 27 per 1,000 below the decennial average.

In point of sickness the Bombay troops stand between the Bengal and Madras armies, but in point of total mortality they showed the worst results. The admission-rate, 1,455 per 1,000 of an average strength of 10,725, though less favourable than that of the preceding year, compares favourably on the whole with recent ratios. The daily sick ratio, 65 per 1,000, was, however, considerably above the average of 1870–79. The total mortality, 19·30, was considerably higher than usual, but this was due in a large measure to the high death-rate from cholera, 4·85, a ratio higher than that of any of the previous years, and more than three times greater than the averages of the ten years, 1870–79, viz., 1·53 per 1,000. In addition, however, to cholera, enteric fever and remittent and continued fevers contributed considerably higher death-rates than those of the preceding year. Loss by invaliding, namely 31 per 1,000, was less than usual, and hence the total loss, which would otherwise have been heavy, was 51, or only 3 per 1,000 greater than the low ratio of the preceding year and 7 per 1,000 less than the average total loss during 1870–79.

The troops stationed in Southern Afghanistan belonged mainly to the Bombay Army, and the statistics relating to them are included in those given in the preceding paragraph. As the conditions and climate under which this section of the Bombay Army serves are peculiar, it is interesting to compare the health of the soldiers serving there with those serving elsewhere in the Bombay Command. The admission-rate in this section of the Bombay Army with an average strength of 1,441 men was 2,056, the daily sick ratio 83, and the total mortality 68·70. It is thus seen that the health of these soldiers was considerably worse than that of the Bombay Army as a whole, and all these ratios are higher than the corresponding ratios for the British Army of India as a whole. Malarial fevers were the chief causes of admission: these accounted for 865 per 1,000 of the total admission-rate. The chief cause of mortality was cholera, the deaths from which were 27 per 1,000. The incidence of this disease in these parts is characterised by remarkable intermittence and virulence. In 1879 the disease attacked the troops quartered there, causing a mortality of 32·69 per 1,000, but between that time and 1884 it remained in complete abeyance. But even excluding cholera, the mortality from all other causes was high, viz., 41·63 against 15·47 in 1883. Enteric fever, malarial fevers, apoplexy, sunstroke, dysentery and respiratory diseases, all contributed much higher death-rates than in the preceding year.

The chief causes of admission into hospital in the three Presidencies are shown in the following table:—

Bengal.		Madras.		Bombay.	
1. Malarial fevers	683	1. Venereal diseases	307	1. Malarial fevers	504
2. Venereal diseases	291	2. Malarial fevers	166	2. Venereal diseases	292
3. Wounds and accidents	124	3. Wounds and accidents	114	3. Wounds and accidents	115
4. Abscess and ulcer	91	4. Abscess and ulcer	87	4. Respiratory diseases	82
5. Respiratory diseases	79	5. Dysentery	56	5. Abscess and ulcer	76
6. Diarrhœa	51	6. Respiratory diseases	46	6. Diarrhœa	53
7. Rheumatism and rheumatic affections.	51	7. Rheumatism and rheumatic affections.	46	7. Rheumatism and rheumatic affections.	41
8. Hepatitis	26	8. Diarrhœa	42	8. Dysentery	26
9. Dysentery	22	9. Hepatitis	36	9. Hepatitis	18
TOTAL OF THE NINE	1,418		900		1,207
TOTAL FROM ALL CAUSES	1,662		1,109		1,455

Malarial fevers in all three Presidencies gave rise to a large proportion of admission, and in all three the ratios for the year under review were greater than those of the preceding year, though the excess was greatest in Bengal. In the foregoing table it

will be seen that the admission-rate for malarial fevers in the Bengal Presidency was 633 per 1,000, an unusually high ratio, exceeding the decennial averages of 1860–69 and 1870–79, which are 633 and 607 respectively. In the Madras Presidency these fevers gave rise to an admission-ratio of 166 per 1,000, which is below the average of 1870–79, viz. 266. Similarly the Bombay ratio, 504, is below the decennial average, viz., 660. Venereal diseases are also a prolific cause of admission, especially in the Madras Presidency, where they indeed head the list of the chief diseases giving rise to admissions. The decennial average admission-rates for these diseases in the three Presidencies are—Bengal 209, Madras 198, and Bombay 191, and the ratios of 1884 exceed these averages in all Presidencies—in Bengal by 82, in Madras by 109, and in Bombay by 101 per 1,000. Wounds and accidents come next, giving the highest ratio in Bengal (124), whilst in Madras and Bombay the ratios are practically the same (114 and 115). These ratios exceed those of the preceding year to a small extent. Respiratory diseases were most prevalent in the Bombay Army. Compared with the preceding year the admission-rates for these diseases were higher in the Madras and Bombay Presidencies, and lower in Bengal. This result is unusual, for the decennial averages are—Bengal 84, Madras 57, and Bombay 64. It is thus seen that in the Bombay Army alone the average was exceeded. Dysentery and hepatitis were more prevalent in Madras than in Bengal and Bombay.

The chief causes of mortality in the British Army of the three Presidencies are stated and contrasted in the following table:—

Deaths from	Bengal.						Madras.						Bombay.					
	1884.	1883.	1882.	1881.*	1880.*	1870-79.	1884.	1883.	1882.	1881.	1880.	1870-79.	1884.	1883.	1882.	1881.*	1880.	1870-79.
Enteric Fever	3·31	2·52	2·90	2·62	3·07	2·28	1·67	2·86	2·09	6·58	1·36	2·42	2·05	1·55	1·99	2·33	5·76	1·75
Apoplexy	1·04	1·32	0·94	1·75	3·14	1·53	0·84	0·38	0·82	0·96	0·78	1·42	1·49	1·10	0·63	1·21	3·03	1·56
Hepatitis	0·84	1·06	1·48	1·64	1·36	2·04	2·04	1·72	1·72	1·54	1·26	3·16	2·03	0·82	0·84	1·52	1·31	1·71
Cholera	1·34	0·94	1·28	3·23	4·84	4·18	0·93	0·95	0·82	1·73	0·10	1·68	4·85	0·82	0·63	0·30	—	1·53
Remittent and continued fevers	0·36	0·41	0·74	0·70	2·34	1·74†	—	0·28	0·27	0·19	0·29	0·62†	2·05	0·55	0·54	0·91	2·73	1·14†
Dysentery	0·18	0·35	0·77	1·00	2·72	1·37	0·37	0·28	0·36	1·15	0·58	2·32	1·03	0·55	0·18	1·82	4·14	0·98
Total of these Diseases	7·07	6·60	8·11	10·94	17·47	13·14	5·85	6·47	6·08	6·15	4·37	10·62	12·50	5·39	4·69	8·59	16·97	8·67
All Causes	11·68	11·21	13·17	17·05	27·73	21·00	8·53	10·19	10·25	10·97	10·18	17·69	19·39	10·50	10·37	18·44	30·90	15·27

* Excluding troops in Afghanistan and on the march. † Including deaths from intermittent fever.

Enteric fever heads the list of diseases, giving rise to the largest proportion of deaths in the Bengal Army alone. During the preceding year this disease stood first in all three Presidencies. The proportion of mortality due to enteric fever in the Bengal Army was 3·31 per 1,000, a larger ratio than in any of the preceding four years and considerably above the average mortality during 1870–79. The next highest ratio, 2·05, is recorded in the Bombay Army. This ratio is higher than that of the two preceding years and also exceeds the decennial average. The ratio of the Madras Army, 1·67, exceeds the decennial average slightly. Compared with decennial averages, cholera was less prevalent than usual in the Bengal and Madras armies, but was more than usually prevalent in the Bombay Army. The unusually high mortality from cholera in the last-mentioned Army has already been alluded to, and will be referred to again in a succeeding paragraph. Hepatitis was as usual most fatal in the Madras Army, where the mortality from it amounted to 2·04, the largest mortality ratio from any one cause. This ratio is still, however, below the decennial average (3·16). In the Bengal Army deaths from this cause amounted to only 0·84 per 1,000 against a decennial average of 2·04. The Bombay Army recorded an intermediate ratio of 1·03 against a ten-year average of 1·71. Of the diseases enumerated in the above table as being the chief causes of mortality enteric fever alone gave rise to higher death-rates than the decennial averages in all three Presidencies. The total absence of mortality from malarial fevers in the Madras Army is noteworthy. In the Bombay Army no less than four of the six diseases enumerated in the table showed higher death-rates than the decennial averages, viz., cholera, malarial fevers, enteric fever, and dysentery in the order of excess.

The geographical groups into which the Bengal Army has been divided (excluding convalescent depôts in which small bodies of troops are located for a few months of

the year only) are enumerated in the following table, together with their admission and death-rates for a series of years:—

Period.	Ratio per 1,000 of strength.													
	Bengal Proper.		Gangetic Provinces and Oudh.		Meerut and Rohilkund.		Agra and Central India.		Punjab.		Hill Stations.		Bengal Presidency.	
	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.
1860–79	1,321	29·57	1,615	28·59	1,576	26·61	2,169	38·48	1,741	25·24	1,069	14·78	1,755	29·98
1870–79*	1,311	14·43	1,410	20·06	1,461	18·31	1,530	18·41	1,847	20·71	1,044	12·23	1,522†	21·00†
1880*	1,469	16·03	1,494	29·32	2,011	22·98	1,935	15·07	2,126	36·41	1,258	20·75	1,818	27·73
1881*	1,610	12·02	1,741	15·94	1,867	17·81	1,728	10·11	1,949	23·44	1,177	9·97	1,729	17·05
1882	1,187	11·19	1,699	22·61	1,613	8·86	1,891	10·51	1,796	12·12	975	8·65	1,579	16·17
1883	1,071	9·10	1,474	17·04	1,528	10·56	1,497	14·27	1,601	9·47	1,454	6·33	1,463	11·21
1884	1,195	10·97	1,381	14·72	2,028	17·01	1,874	15·53	1,992	9·75	1,201	5·91	1,662	11·68

* Excluding troops in Afghanistan and on the march. † Including troops in Afghanistan and on the march.

Of these groups sickness as compared with the approximate averages of the 20 years, 1860–79, was more than usually prevalent in the Meerut and Rohilkund, Punjab, Hill Stations, and Agra and Central India groups in the order of excess of admission-rates over approximate averages. Malarial fevers and venereal diseases in all groups contributed most largely to the total admission-rates. Malarial fevers, on the whole, gave rise to from three to four times as many admissions in the Meerut—Rohilkhund, Agra with Central India and Punjab groups, as in the Bengal, Gangetic Provinces, and Hill Stations groups. Venereal diseases gave rise to the largest proportion of admissions in the first three groups. Respiratory diseases were most prevalent in the Punjab, Hill Stations, and Meerut and Rohilkund groups in the above order.

Compared with the ratios of the preceding year, the death-rates in the Bengal, Meerut, Agra, and Central India and Punjab groups were greater. Compared, however, with the average mortality ratios of the 20 years, 1860–79, the ratios of 1884 are in all cases lower. In the Punjab group the death-rate of the year under review was 13·53 per 1,000 less than the 20 years' average. In the Lower Bengal group 12·87, in the Gangetic Provinces 10·31, in the Hill Stations 7·14, in the Meerut 6·19, and in the Agra and Central India group 13·82 below the same averages. In all groups, with the exception of the Hill Stations, enteric fever gave rise to the highest proportion of mortality. In the Agra and Central India group the mortality from this cause rose to 7·51 per 1,000. The next highest ratios were recorded in the Meerut (4·19), Gangetic Provinces (3·96), and Lower Bengal (3·18) groups. Excluding the Hill Stations group, all groups returned higher mortality ratios from this cause than during the previous year, and compared with the average mortality during 1870–79, the first four groups show higher ratios, whilst the ratio of the fifth group (Punjab) is almost identical with the average. Apoplexy caused the largest proportion of deaths in the third, fifth, second, and fourth groups in order; hepatitis in the second, fifth, and third groups; respiratory diseases in the third, fifth, and fourth groups. Dysentery caused some mortality in the third and fifth groups, but none in the remaining groups.

Confining attention to those only of the stations in which the average strength exceeded 200, and which were occupied throughout the year, the highest admission-rates were recorded at Delhi (4,828 per 1,000) and Mecan Meer (3,554). At six stations admission-rates exceeded 2,000, and in five they were under 1,000, the smallest ratio having been 828 at Cannanore. The highest mortality among such stations occurred in Quetta (38·00 per 1,000), and Hyderabad in Sind (32·68). In five stations the ratios were between 20 and 30 per 1,000, in 21 between 10 and 20, and in 27 below 10.

During the year 9,244 men of the Bengal Army, or 27·60 per cent. of strength, were located on the hills. The men located in the Hill Stations enjoyed better health than they did during the preceding year, for the admissions among them equalled 1,201 per 1,000 against 1,454 in 1883; the ratio of 1884 is still, however, higher than usual, for the decennial average of 1870–79 was 1,044. The death-rate was remarkably low, namely, 5·91 per 1,000, the lowest on record since 1870.

The health statistics of the troops of the Rajputana, Malwa, Sind, and Aden group were on the whole favourable. Compared with the ratios of the preceding year, the admission and death-rates (1,548 and 12·77 per 1,000 respectively) are higher, but they are both considerably below the decennial averages of 1870–79. Fevers and venereal diseases as usual gave rise to the largest proportion of admissions; the next highest ratios having been for wounds and accidents, abscesses and ulcers, respiratory diseases,

and diarrhœa. The causes of death were enteric fever (2·02), apoplexy and sunstroke (1·79), cholera and hepatitis (each 1·12). The largest stations included in this group are Mhow and Aden. The former recorded an admission-rate of 1,799 and a death-rate of 6·69; the latter 1,167 and 8·51 respectively.

The health statistics of the troops in the Deccan and Nagpur are on the whole favourable. The admission-rate, 1,171, is certainly higher than it was during the previous year (viz., 1,001, the most favourable on record since 1870), but it compares favourably with the average of 1870–79, which is 1,383. The total death-rate was low, namely, 8·83, against a decennial average of 14·14. Venereal diseases caused the largest proportion of admissions, and next malarial fevers. The chief causes of death were enteric fever, hepatitis, remittent and continued fevers. Secunderabad, the largest military cantonment in India, with an average strength of 2,394, and Poona, with an average strength of 1,019, are included in this group. At Secunderabad the admission-rate was 1,077, and at Poona 1,129, the death-rates having been 9·61 and 9·81 respectively.

The admission-rate for the troops included in the Southern India group was 1,059, a favourable ratio compared with the last ten-year average, which is 1,285. The total death-rate was 7·73, one of the lowest on record, and considerably below the decennial average, 13·70. Venereal diseases contributed 358 per 1,000 to the total admission-rate, whilst malarial fevers caused only 99 per 1,000 of admissions. Dysentery and diarrhœa together gave rise to 92 per 1,000 of admissions. Enteric fever, cholera, apoplexy with sunstroke, and hepatitis, each contributed a little over 1 per 1,000 to the total mortality. This group includes seven stations, the largest of which are Bangalore, Bellary, Cannanore, and Madras. At Bangalore, with an average strength of 1,964, the admission-rate was 1,026, and the death-rate 4·07; at Bellary these ratios were 963 and 7·15.

The average strength of the Burma and Pegu group, including four stations, was 1,785. The total admission-rate, 1,190, was higher than usual, the last decennial average having been 1,092, but the death-rate, 7·28, was very favourable, the ten-year average having been 17·32. Venereal diseases, fevers, and bowel complaints gave rise, as usual, to the largest proportion of admissions, whilst bowel complaints, hepatitis, and phthisis pulmonalis contributed most largely to the death-rate. It is noteworthy that enteric fever gave rise to no deaths, though four cases were treated. Rangoon, Toungoo, Thayetmyo, and Port Blair are the four stations included in this group, the last with an average strength only of 140. The highest admission and death-rates were recorded at Rangoon, 1,586 and 12·43 respectively.

The average strength of the men located in the hill stations of Madras and Bombay was 757. Sickness among them prevailed to the usual extent, the admission-rate of the year having been 1,531 compared with 1,594, the decennial average. Mortality among them, however, 5·28 per 1,000, was considerably below the average of the 10 years, which is 15·16.

Throughout the Army of India 150 cases of cholera were treated, or a proportion of 2·7 per 1,000 of strength. Of this number 107 died, or 71·33 per cent. of those attacked. The prevalence of the disease among the European troops was therefore not great, though greater than in the two preceding years, for during 1882 only 98 cases were treated and 82 during 1883. The type of the disease was, however, more virulent, for the per-centage of deaths among those treated exceeded the per-centages of 1882 and 1883, which were 62·24 and 62·20 respectively, whilst the average admission-rate during 1870–79 was 4·7, and the average per-centage of deaths to seizures 69·11. Cholera.

Of the total 150 cases of the disease, no less than 67 occurred in the Bombay Army. The disease was unusually prevalent in this army, the admission-rate per 1,000 of strength having been exactly three times the average ratio during 1870–79, which was 2·1. It has been noted already that the disease broke out chiefly among the troops occupying Southern Afghanistan. Among these troops 49 cases were treated, and of these 39, or 79·59 per cent., proved fatal. The disease among the men serving there was therefore extremely virulent. The average per-centage of deaths to those treated in the Presidency as a whole during 1870–79 was 73·27.

The troops of the Bengal Presidency come next in order of high proportionate attacks. Among them 71 cases occurred, a proportion to strength of 2·1 per 1,000. These numbers are nearly double the corresponding ones of the preceding year, but in that year the disease was remarkably little prevalent. The average admission-rate for the last decade was 5·9. Of those attacked 45 died, a per-centage of 63·38, which is below the average per-centage of 1870–79, namely, 70·26.

Only 12 cases occurred in the Madras Presidency, representing a ratio of 1·1 per 1,000 against an average of 2·9 during 1870–79. Of those attacked 10 died, yielding the very high per-centage of 83·33, the last ten-year average having been 58·49.

Among the troops of the several geographical groups of the Bengal Army the disease was entirely absent from two of the groups, while it was unusually prevalent in one, namely, the Meerut and Rohilkund group. The admission-rate in this group, 8·4 per 1,000, was more than three times as great as the average admission-rate during the last decade, and nearly equalled the average of 1860–69. Thirty-two men were treated, of whom 16 died, equivalent to 50 per cent. The type of the disease was therefore happily not so severe as usual, for the average per-centage of deaths to attacks during 1870–79 was 68·91. During the preceding year this group remained entirely free of the disease. During recent years the Gangetic Provinces have usually suffered more severely than any of the other groups. It is satisfactory, therefore, to note a diminished prevalence of the disease in this group during the year under report. Twenty-eight cases were admitted (4·4 per 1,000), of whom 20 died, or 71·43 per cent. of those attacked. The last-mentioned ratio is unusually high, the decennial average for 1870–79 having been 63·96. In the Agra and Central India group the admission-rate (2·0) was about one-half the decennial average. Eight cases occurred with seven deaths, or 87·50 per cent. of those attacked, against a ten-year average of 72·38. In Bengal Proper the admission-rate (1·6) was almost identical with the last decennial average. It may be noted that this is the third consecutive year during which the troops in the Punjab remained entirely free of the disease.

Small-pox.

Small-pox was less prevalent in the Army as a whole than it was during 1883. Seventy-eight cases in all were treated (1·4 per 1,000 of strength), of whom 8 died (or 0·14 per 1,000). Both these ratios are greater than the decennial averages of 1870–79, which were 0·7 and 0·10 respectively. The per-centage of deaths amongst those treated was 10·26 against 8·57 in 1883, and 14·71 during 1870–79.

The disease was proportionately most prevalent in the Madras Presidency, where 19 cases occurred, or 1·8 per 1,000 of strength, against 0·5 during 1870–79. Of these only one proved fatal. In the Bengal Presidency 51 cases were admitted (1·5 per 1,000 against 0·8 in 1870–79). The cases were distributed as follows: Gangetic Provinces, 33 cases with 4 deaths; Meerut and Rohilkund, 5 cases with no death; Agra and Central India, 4 cases with no death; Punjab, 8 cases with 2 deaths; and Hill Stations, one case with no death. Fifty-five of the whole number of cases occurred during March, April, and May. In the Bombay Presidency only 8 cases with one death were reported.

Fevers.

In the report for 1883 a great diminution in the prevalence of intermittent fevers was noted. Unhappily this has not continued, for during 1884 the admission-rate for the whole Army of India rose from 359 per 1,000 during the preceding year to 487, a ratio which considerably exceeds the average of the last decade, namely, 389. The excess over the decennial average for the Army of India, however, was entirely due to an increased prevalence of these fevers in the Bengal Presidency, for in the Madras and Bombay Presidencies the admission-ratios of the year were below their decennial averages, whilst in Bengal the ratio of 1884 exceeded the average by 198 per 1,000. It is satisfactory, however, to observe that this increased prevalence of the disease was not accompanied by an increased mortality; indeed the total mortality due to these fevers throughout the Army of India, 0·02 (and representing the death of one man), was below that of the previous year, and nearly seven times less than the average mortality of the last decade.

With an increased prevalence of intermittent fevers, as compared with the previous year, it is not surprising to find an increased prevalence also of the continued forms of malarial fever. The admission-rate for these fevers equalled 60 per 1,000 for the Army of India as a whole against 49 in 1883. The last-mentioned ratio was, however, unusually low, and the ratio of 1884 is considerably below the last decennial average, which was 162 per 1,000. The increased prevalence of these fevers, as compared with the preceding year, was mainly due to the greater incidence of the disease upon the Bombay troops.

Enteric fever.

The number of fever cases now regarded as enteric has risen steadily during recent years. During 1883, 429 cases were admitted into hospital, or 7·7 per 1,000 of strength, whilst in the year under report 644 cases, or 11·7 per 1,000 of average strength, were recorded to have occurred throughout the Army of India. In several

former reports the difficulty attending the diagnosis of this fever from continued malarial fevers and the probability that many cases of the latter have been recorded as enteric has been commented upon, and it is needless to repeat these arguments here. In a subsequent paragraph it will be observed that the Surgeon-General, Bombay, in reporting on the prevalence of enteric fever in the Bombay Army, takes the same view and shows that much confusion exists in the diagnosis of this fever. It will suffice here to compare the results of 1884 with those of nine previous years since 1875 and the approximate averages of the 10 years from that time to the year under report (1884) inclusive. In the following table the admission and death-rates per 1,000 of strength for each of these years is set forth, together with the per-centages of deaths among those treated:—

Year.	Ratios per 1,000 of		Died per cent. of those treated.	Year.	Ratios per 1,000 of		Died per cent. of those treated.
	Admissions.	Deaths.			Admissions.	Deaths.	
1884	11·7	2·74	23·45	1878	8·5	3·64	43·01
1883	7·7	2·40	31·00	1877	4·1	1·60	39·49
1882	6·2	2·55	40·90	1876	4·6	1·82	39·77
1881	5·6	2·64	47·26	1875	2·8	1·44	50·60
1880	7·9	3·63	46·17	1875–84	6·7	2·61	39·08
1879	8·0	3·59	45·01				

An examination of these ratios shows (first) that, during the first three years of the decade these fevers were not so prevalent as they are now, and that compared with the admission-rate their fatality was much greater; (second) that during 1878-79-80 there was a marked increase in the prevalence of the disease, and that the fatality of the disease *in comparison with the admission-rates* was diminished; (third) that during 1881 there was a sudden diminution in the prevalence of the disease, coupled with an increased mortality, in the same sense as above (a mortality almost the same in proportion to admissions as occurred in 1875); (fourth) that since 1881 there has been a very rapid increase in the prevalence of the disease, together with a remarkable fall in the fatality of it, for though the admission-rate during 1884 was considerably higher than in any previous year, the per-centage of death among those treated was never so low. Comparing next the ratios for 1884 with the approximate decennial averages, it will be observed that, though the admission-rate during 1884 was nearly double, the proportion of deaths among those attacked was nearly one-half the average.

In the following table the admission and death-rates for enteric fever and other fevers in the three Presidencies are contrasted:—

Period.	Bengal.						Madras.						Bombay.					
	Admissions per 1,000.			Deaths per 1,000.			Admissions per 1,000.			Deaths per 1,000.			Admissions per 1,000.			Deaths per 1,000.		
	Enteric Fever.	Other Fevers.	Total.	Enteric Fever.	Other Fevers.	Total.	Enteric Fever.	Other Fevers.	Total.	Enteric Fever.	Other Fevers.	Total.	Enteric Fever.	Other Fevers.	Total.	Enteric Fever.	Other Fevers.	Total.
1870–79*	5·3	307·3	612·6	2·28	1·74	4·02	3·9	263·5	276·4	1·49	0·83	2·06	3·1	439·2	993·6	1·75	1·14	2·89
1880†	8·7	809·6	818·3	3·07	2·66	5·73	2·6	450·1	482·7	1·36	0·39	1·75	9·5	1,117·3	1,126·8	5·76	3·23	8·99
1881†	6·3	763·9	770·2	2·62	0·81	3·43	0·9	278·7	279·6	0·58	0·19	0·77	4·2	840·6	844·8	2·83	0·91	3·74
1882	7·3	600·0	667·3	2·90	0·77	3·67	4·0	171·5	175·5	2·09	0·27	2·36	5·1	558·5	563·6	1·90	0·81	2·71
1883	8·1	486·4	494·5	2·62	0·44	2·96	8·6	128·4	137·0	2·96	0·28	3·14	8·7	436·4	443·1	1·65	0·73	2·28
1884	12·6	682·8	695·4	3·31	0·36	3·67	11·4	166·0	177·4	1·67	—	1·67	9·1	504·4	513·5	2·65	2·14	4·18

* Including troops on active service and on the march. † Excluding troops in Afghanistan.

Both enteric fever and other fevers were more prevalent in the Bengal Army than in those of Madras and Bombay. The admission-rate for enteric fever in the Bengal Army, namely, 12·6, is more than double the average ratio of the past decade (5·3); but other fevers were also unusually prevalent, for, whilst the admission-ratio for them during 1884 was 682·8, the decennial average was 607·3. The next highest admission-rate for enteric fever was recorded in the Madras Army, namely, 11·4, closely approaching the Bengal ratio, but other fevers in this army were much less prevalent, the admission-rate for them, 166, having been very considerably below the ten-year average, namely, 266·5. In the Bombay Army enteric fever gave rise to nearly three times as many admissions proportionately to strength as the average of the last decade, namely, 9·1, against an average of 3·1. In this as in the Madras Army other fevers were not so prevalent as usual. Looking next to the total

admission and death-rates in the three armies for both enteric and other fevers together, it will be observed that in the Bengal Army alone does the combined admission-ratio of the year under report exceed the decennial average of 1870-79, yet the total combined death-rate, notwithstanding the fact that there were amongst the cases of fever more than twice as many enteric fever cases in proportion to strength, was below the decennial average. In the Madras Army the combined admission-rate was 177·4 against a ten-year average of 270·4, and although the ratio of the year includes nearly three times as many cases of enteric fever as does the decennial average, yet the combined death-rate was 1·67 against 2·04. In the Bombay Army there were nearly three times as many admissions from enteric fever as during 1870-79, and the total death-rate was also greater, namely, 4·19 in 1884 against an average of 2·89.

The following table is introduced to show the fluctuations in the death-rates from enteric and other fevers during the years 1871-1884 :—

Presidencies.	Fevers.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	1880.	1881.*	1882.	1883.	1884.
Bengal	Intermittent, remittent, and continued.	2·25	1·78	1·32	1·70	1·18	0·71	0·66	1·59	2·63*	2·66*	0·81	0·77	0·44	0·36
	Enteric - - -	1·71	1·62	1·53	2·01	1·59	1·75	1·55	4·69	3·86*	3·07*	2·62	2·90	2·52	3·31
	Total -	3·96	3·40	2·92	3·12	2·77	2·46	2·21	6·28	6·49*	5·73*	3·43	3·67	2·96	3·67
Madras	Intermittent, remittent, and continued.	0·83	0·69	0·79	0·17	0·36	0·46	0·27	1·11	0·76	0·89	0·19	0·27	0·28	—
	Enteric - - -	1·47	2·34	0·78	1·04	0·63	1·99	2·00	1·20	1·44	1·36	0·58	2·09	2·86	1·67
	Total -	2·30	3·03	1·48	1·21	0·99	2·45	2·27	2·31	2·20	1·75	0·77	2·36	3·14	1·67
Bombay	Intermittent, remittent, and continued.	1·01	0·74	0·56	0·76	1·28	0·29	0·50	1·12	1·61	3·28	0·91	0·81	0·73	2·14
	Enteric „ - -	1·48	2·22	1·31	1·33	1·77	1·86	1·39	2·55	1·93	5·76	2·83	1·90	1·55	2·05
	Total -	2·49	2·96	1·87	2·09	3·05	2·15	1·89	3·67	3·54	8·99	3·74	2·71	2·28	4·19

* Excluding troops in Afghanistan.

The foregoing tables will, it is hoped, have given an insight into any relationship which may exist between enteric and malarial fevers. Their main results are brought together in the following table for facility of comparison :—

Mortality from Enteric Fever and other Fevers.

	During 1870-79.			During 1884.		
	Enteric fever.	Other fevers.	Total of both.	Enteric fever.	Other fevers.	Total of both.
Army of India - - -	2·03	1·42	3·45	2·74	0·64	3·38
„ Bengal - - -	2·28	1·74	4·02	3·31	0·36	3·67
„ Madras - - -	1·42	0·62	2·04	1·67	—	1·67
„ Bombay - - -	1·75	1·14	2·89	2·05	2·14	4·19

The question as to whether all the fevers now so often called enteric are really specifically distinct from malarial fevers, and whether, if this be so, these fevers are specifically the same as the fevers similarly named in Europe will have to be decided upon clinical and pathological data. As far as the indications of statistics may be relied on, they tend to show only that, if the fevers now called enteric are really specifically distinct from malarial fevers, they have always been so, though they have escaped observation, and are probably not to be regarded as a newly introduced disease into India. It was indeed to be expected that a more careful observation of fevers stimulated by the introduction of improved and accessible instruments of research should result in the separation of some of their forms as distinct which were formerly regarded as the same. This view is supported by the results set forth in the above tables, which show that the total mortality from all forms of fever does not on the whole materially differ from what it was 13 years ago, and this is hardly compatible with the view that a new and fatal fever has been recently introduced into India.

The disease again gave rise, as during the preceding year, to the largest number of admissions in Lucknow and Bangalore stations. At Lucknow 55 cases were admitted into hospital, of which 9 proved fatal, against 44 cases and 8 deaths during 1883.

The deaths amongst those attacked were therefore comparatively fewer—16·4 per cent. against 18·2 per cent. in 1883. At Bangalore 60 cases with only one death were recorded against 40 with 14 deaths in 1883. At Secunderabad there were 36 cases and 10 deaths, at Morar 33 cases with 17 deaths, and at Quetta 32 cases with 10 deaths. Over 20 cases were recorded at Sitapur, Meerut, Agra, Mooltan, Rawal Pindi, and Karachi.

The relationship between enteric fever and age is exhibited in the following table:—

Year.	Mortality from Enteric Fever and Ratio of Liability to it at Different Ages.					
	Under 25.		25 to 29.		30 to 34.	
	Deaths per 1,000.	Percentage of liability.	Deaths per 1,000.	Percentage of liability.	Deaths per 1,000.	Percentage of liability.
1877	2·45	44·2	1·55	27·9	0·99	17·8
1878	6·04	53·0	3·55	31·1	2·04	9·1
1879	6·17	54·1	2·73	23·9	1·78	15·6
1880	6·25	56·26	3·15	28·35	1·09	9·81
1881	4·56	59·84	1·57	20·60	0·72	10·37
1882	4·32	56·18	1·55	20·16	0·78	10·14
1883	4·34	66·36	1·50	22·94	0·70	10·70
1884	4·61	62·05	1·83	24·63	—	—

The results given do not differ materially from those of recent years, and their significance has been repeatedly indicated in recent annual reports.

As with age, so with length of service in India, the disease stands in well-defined relationship. With increased service in India liability to become affected by the disease rapidly diminishes:—

Statement showing the proportion of men who have served in India two, five, and seven years from 1871–84.

Period.	Percentage of Men to Total Strength who have served in India.			Period.	Percentage of Men to Total Strength who have served in India.		
	Two Years and under.	Five Years and under.	Seven Years and under.		Two Years and under.	Five Years and under.	Seven Years and under.
1871	36·2	64·6	78·9	1878	28·9	59·8	73·0
1872	33·7	66·7	80·0	1879	32·1	60·9	72·6
1873	31·7	65·5	79·6	1880	33·4	65·4	77·2
1874	25·9	64·3	79·8	1881	38·9	70·4	81·1
1875	26·1	60·1	81·0	1882	33·1	71·9	82·9
1876	25·5	57·6	75·2	1883	32·3	74·7	85·5
1877	25·2	56·2	72·6	1884	36·2	75·0	86·2

Statement showing the death-ratios of the European Army from Enteric Fever at different periods of residence in India, together with Ratios of Liability to it, for 1877–84.

Year.	Mortality from Enteric Fever, and Ratio of Liability to it at Different Periods of Residence in India.					
	1st and 2nd Years.		3rd to 6th Year.		7th to 10th Year.	
	Deaths per 1,000.	Percentage of liability.	Deaths per 1,000.	Percentage of liability.	Deaths per 1,000.	Percentage of liability.
1877	3·34	59·5	1·35	24·2	0·90	16·1
1878	7·90	63·4	2·64	21·2	1·38	11·0
1879	7·99	67·2	2·18	18·3	1·24	10·4
1880	9·08	75·98	1·78	14·90	0·47	3·93
1881	4·55	60·02	2·07	27·31	0·56	7·39
1882	4·68	61·10	1·93	25·19	0·34	4·44
1883	4·98	70·34	1·55	21·89	0·55	7·77
1884	5·47	70·04	1·55	19·85	0·46	5·89

The average strength of the European Army in Bengal Proper is so small that it may be omitted in considering the relationship of enteric fever to season. In all the remaining geographical groups there are two periods of increased incidence of the disease—one April to May, the other August to October. These two periods are most clearly defined in the Punjab and Meerut—Rohilkund groups, where the intensity of incidence is almost equal in the two periods. In the Gangetic Provinces and Oudh group the earlier period of invasion is more marked than the latter, whilst in the Agra and Central India group the reverse obtains, the earlier period being almost obliterated. In all these groups, with the exception of the last-mentioned, namely, Agra and Central India, a tendency to increased activity in the disease manifests itself, though not conspicuously, towards the close of the year.

In the great majority of cases medical officers, in reporting upon the outbreaks of the disease coming under their immediate observations, state that no clue whatever can be found to the causation of the disease in any local insanitary conditions. In most cases the sanitary conditions of the soldiers' surroundings were unexceptionable; for example, at Morar, where in one regiment 33 men were admitted, of whom 17 died, the Medical Officer writes:—"The disease generally was of a bad type, and the "patients were greatly handicapped by the oppressive nature of the weather in "August and September, and I may also add in May and June, for I find that "four deaths occurred during these two months when the heat was very great. I can "in no other way account for the high mortality." The average age of the men attacked at Morar was 23·24. Eighteen cases occurred in men who had been a year or less in India. The average length of residence in India of the men attacked was two years and two months. Nearly every barrack furnished one or more cases. The Medical Officer continues:—"I cannot offer any satisfactory explanation of the cause of the "outbreak. Careful inspection of the barracks and vicinity failed at any time to "reveal more than a few trifling sanitary defects. The milk supply of the troops was "carefully inquired into. It was thought that stable litter might have been used to "feed the cows with, but I made several minute personal inspections of the village, "where all the cows which provide milk for the troops are obliged to be kept under "supervision, and I always found the cow-sheds clean, and that the cows were well "looked after and fed on clean grass and *kerbi*. In the Norfolk Regiment in the same "station (in which 26 cases occurred), milk was not allowed to be hawked about in "vessels for sale, but the cows were driven about the barracks and milked direct into "the vessels of the men. In the absence, therefore, of insanitary conditions I can only "assign the occurrence of so many cases of enteric fever in Morar during 1884 to "climatic causes and to individual susceptibility." Again at Lucknow, where 53 cases were treated, with nine deaths, the Medical Officer writes:—"The source of the "disease could not be ascertained in any of these cases. The sanitary condition of "the barracks and the vicinity was always in excellent order, the water-supply was "very good, and the filters were well attended to." At Sitapur, where 24 cases with four deaths occurred, we have a striking example of difference of opinion in the diagnosis of the disease. The Medical Officer apparently regarded only about one-half of the cases as enteric, but his successor differing in opinion writes:—"In the weekly "returns only 13 cases were shown as enteric fever; but as I had reason to believe "that the diagnosis was incorrect in 11 other cases returned as simple continued "fever, I have made the necessary correction in the annual return." This Medical Officer attributes the disease to the use of porous vessels in latrines. He continues—"On the 19th April, I find I made the following entry in the diary:—Of four admis-"sions from enteric fever during the past week, three men belong to 'G' Company "and came from No. 4 single-storied barrack; other cases of fever and of tonsillitis, "or sore-throat, have also recently been admitted from the same barrack. I made a "close inspection of this barrack and all its surroundings. I not only found that 'G' "Company was the most exposed to latrine air, but that the latrine of the guard-room "was the most conserved throughout the barracks. I consequently came to the "conclusion that it was in the latrines I must look for the cause of the sickness. The "latrines had generally the appearance of being well attended to, and were always "reported to be in 'satisfactory condition': but I always perceived a stench in them "which could not be accounted for by want of ventilation. I discovered that this "was due to the privy-pans, which being of unglazed earthenware, somewhat similar "to common Indian flower-pots, and very pervious, had become saturated with "excrement, now as the weather had become hot, in a decomposing state. I there-"fore attributed the occurrence of enteric fever to the air having become polluted

" with decomposing excrement. I think I should here state that the pans referred " to had been brushed over with a coating of varnish by the contractor or his agent, " and thus passed for the proper glazed earthenware pans. This had been done for " several years, and the last regiment, fresh from home, naturally imagined that the " previous corps had the correct article, and continued to receive it. I would also " here remark that, after the proper glazed earthenware pans were supplied, the latrines " became perfectly free from stench—in fact from any smell; the health of the troops " improved; there were no more admissions for enteric fever; and a very considerable " decrease in the number of admissions for diseases of the digestive system." At Roorkee the Medical Officer in charge of the station hospital states that all the four cases which occurred during the year, as well as all those which occurred during the previous three years, came from the same end of the infantry barracks. He writes— " but the causative agency has not been traced in any of the cases. The buildings " at this end of the barracks are in every respect the same as at the other, and " the food, water, and other supplies for the residents are obtained from the same " sources."

In commenting on the much greater prevalence of enteric fever in the Madras Army during 1884 than in any previous year, and the concomitant reduction in the mortality amongst those attacked, the Surgeon-General, Madras, writes:—"This is probably " accounted for by the fact that executive medical officers have become more careful " in their diagnosis, and that cases are now included under the head of enteric fever " which were formerly returned under the headings of simple continued or remittent " fevers." This is the alternative view to that taken in several previous annual reports of the Sanitary Commissioner with the Government of India, viz., that the increasing admission-ratios for this fever are due rather to a hesitating or timid diagnosis by which many cases of malarial fever of more than ordinary severity are entered in returns as enteric. The reasons for preferring this latter alternative opinion have been given from time to time in former reports as well as in a previous paragraph of this report. The well-established fact that these fevers are almost exclusively confined to the young unacclimatised soldier, and that its seasonal prevalence coincides with the season of greatest prevalence of ordinary malarial fevers, lends support to the view here taken. In the Madras Army, of the 129 cases which were admitted into hospital, no less than 65, or almost exactly one-half, occurred during the months of July, August, and September, the period during which other fevers are most prevalent, for, of the 1,790 admissions for other fevers made during the year, 567, or a little more than one-third, were made during these months. The result is even more striking if we confine attention to the stations in which the disease was most prevalent, viz., Bangalore, Secunderabad, and Kamptee. In these three stations 109 of the whole number of enteric fever cases occurred. Sixty-three of the 109 cases of enteric fever occurred during the months of July, August, and September, and 343 of the 902 cases of other fevers occurred during the same months, or about one-third of the whole. In connexion with this subject it is interesting to note that, amongst the Native troops serving in Bangalore and Secunderabad, only three cases of enteric fever were treated during the year.

The Surgeon-General, Bombay, in reporting on the prevalence of enteric fever amongst British troops in that command during 1884 takes a different view from that of the Surgeon-General, Madras, and one that coincides in most respects with the view supported in these annual reports for several preceding years. He is of opinion that "there is a form of fever called enteric fever which is not that disease *proper*, " but which is due to *malaria*, and presents great difficulties in diagnosis from true " enteric fever"; and secondly, that "we have pure enteric fever which he believes " might almost invariably be traced to pre-existing causes if our information were " complete." Throughout the Bombay Army 98 admissions were made for enteric fever with 22 deaths, or equivalent to very nearly one death in 4·5 cases. The disease was specially prevalent in Quetta and Karachi, in which stations 30 and 28 admissions respectively were made. The greatest number of cases occurred during July, August, and September. The disproportion in the ratio of deaths to cases treated at different stations is very noticeable, "for," as the Surgeon-General writes, "whilst Ahmednagar " shows a series of 10 cases without one death, Quetta shows a mortality which almost " approaches that of cholera, viz., one death in every three cases; Karachi shows, on " the other hand, a mortality of only 1 in 9." With regard to the outbreak at Quetta, it is noted that sickness generally was unusually prevalent during the latter half of the year, and all the cases of enteric fever were admitted during this time.

In the marginal table the admissions for all diseases at Quetta, and an analysis of them showing the share taken by fevers of all kinds in them during the latter half of the year, are given. In regard to these figures the Surgeon-General writes:—"It "will be observed that, during what "may be called the four fatal months

Admissions: Quetta.

	Total admissions.	Fevers as whole.	Intermittent fever.	Remittent and continued fevers.	Enteric fever.
June	159	42	23	17	—
July	201	50	19	26	4
August	334	110	59	47	4
September	343	227	88	133	16
October	332	207	161	39	6

"of 1884 in Quetta (July, August, September, and October), those severest forms of "climatic fevers (remittent and continued fevers) were far more prevalent than the "milder intermittents; it will also be seen that, during these four months, all the "enteric cases occurred. It is also worthy of note that, during the month of "September, when remittent and continued fevers were rampant, half the cases of "enteric fever occurred." In connexion with this outbreak the difficulties attending the diagnosis of true enteric fever from malarial fevers of a continued type are set forth as follows:—"That difficulties in diagnosis presented themselves to the medical "officers at Quetta is abundantly shown in my last quotation from the reports of "Dr. Bradshaw, wherein the officer in charge of the Station Hospital announces that, "for the week ending the 12th September, 7 cases of enteric fever were admitted, "but of these no fewer than 6 were 'revisions of diagnosis,' *i.e.*, these 6 cases had "been under treatment up to the 5th September for some other disease. Now, of all "the diseases prevailing at Quetta, remittent fever and continued fever of a malarial "character are the fevers which in all probability would present those difficulties in "diagnosis from enteric fever to which I have referred. If we remember that enteric "fever is a continued fever of long duration, and that it has always been regarded "*per se* as distinctly non-malarial, may we not hesitate in pronouncing all those "30 cases which occurred at Quetta as enteric fever? Especially do I consider it "doubtful, seeing how we have noted that, in one week, 6 of those cases were revisions "of diagnosis, these having been presumably originally treated as either remittent or "malarial continued fever."

After fully considering the outbreak in the Quetta district, he says that he is of "opinion that many of the cases were possibly aggravated forms of continued or remittent fevers which in their progress assumed 'typhoid' character."

Bowel complaints.

Dysentery was somewhat more prevalent in the army as a whole than during the preceding year, the admission-rate having been 29 against 27 per 1,000; but the former ratio is considerably under the average of the last decade, namely, 40. Diarrhœa gave rise to an admission-rate of 50 per 1,000 against a decennial average of 63 per 1,000. The severity of the cases of dysentery treated was not so great as during the previous year, for the per-centage of deaths to those treated was 1·31 against 1·40 in 1883 and 3·65 during 1870–79. Diarrhœa was of a severer type, the per-centage of deaths having been 1·08 against 0·08 in 1883 and 0·19 the average of the last ten-year period. Dysentery was most prevalent as usual in the Madras Army, but it caused the largest proportion of deaths to strength in the Bombay Army. Diarhœa, on the other hand, was more prevalent in the Bengal and Bombay armies.

Apoplexy.

Apoplexy and sunstroke gave rise to an admission-rate equal to that of the preceding year, namely, 3 per 1,000, and to an almost identical death-rate, namely, 1·09 against 1·10.

Hepatitis.

There was some reduction in the admission-rate for hepatitis in the army as a whole compared with the preceding year (26 per 1,000 against 29 in 1883), a reduction shared in by each of the three Presidential armies, but especially by the Madras and Bombay armies. The mortality caused by this affection in the army as a whole was almost exactly one-half the average mortality of the last decade, namely, 1·11 against 2·19. This total reduction was mainly due to the diminished mortality in the Bengal and Madras armies whose death-ratios for the year under review are 1·20 and 1·12 per 1,000 below their respective ten-year averages, whilst in the Bombay Army this difference amounts to only 0·68. Of the several groups into which the Bengal Army has been divided, this disease caused the largest admission-rates in the Meerut and Rohilkund group (33 per 1,000), Agra and Central India group (28), and Gangetic Provinces (27).

ype of disease was most severe in the Gangetic Provinces, where 4·68 per cent. of hose treated died; next in the Punjab, where this per-centage was 3·37. It was least atal in Agra and Central India, where only 0·89 per cent. died. Of the remaining roups of the Army of India, the Burma with Pegu and Southern India groups yielded igh admission-rates, viz., 37 and 33 respectively, whilst the highest per-centages of eaths to those attacked were recorded in Southern Afghanistan (8·33 per cent.), Deccan (7·64), and Rajputana, &c. (7·46).

Respiratory diseases.

It is satisfactory to observe that the rise in the admission-rate from respiratory liseases in the Army of India as a whole, which was noted in the report for 1883, has ot continued. The admission-rate for the year under report, namely, 78 per 1,000, is 2 per 1,000 below the average of the last decade. The total mortality due to these liseases, namely, 0·73 per 1,000, though less than the last decennial average, was omewhat greater than the ratio of 1883.

The Bombay Army recorded the highest ratios both as regards admissions and deaths. This is mainly attributable to the high ratios prevalent in the portion of the Bombay Army located in Southern Afghanistan. In this section of the Bombay Army the dmission and death-rates were 165 and 6·25 respectively against 82 and 1·40, the orresponning ratios of the Bombay Army as a whole. Of the various sections of he Bengal Army, excluding hill stations, the highest admission-rates occurred in the Punjab (88 per 1,000), and Meerut and Rohilkund (81 per 1,000), whilst the lowest vere recorded in Bengal Proper (37 per 1,000), and Gangetic Provinces with Oudh 70 per 1,000). Comparing the ratios of admission during the year under report with he ten-year averages of 1870–79, it will be seen that, whilst in the Bengal and Madras Armies those of the year are below the averages, in Bombay the ratio of 1884 xceeds the average by 18 per 1,000. The same excess of the present year's result ver the last ten-year average is observable in the mortality due to these diseases in he Bombay Army, namely, an excess of 0·70 per 1,000, whilst in the two other armies he results of 1884 are below the average.

Venereal disease in Army of India as a whole.

In the report for 1883 it was noted that the admission-rates for these diseases in the European Army of India had steadily risen. The result of another year's experience dds unfortunately to the progressive series of increased admission-rates, for during 884 it was 294 per 1,000 against 270 in 1883, and 203 the average of 1870–79; and his rise in admission-rate for the army as a whole was shared in by each of the three residential armies, most largely by that of Bombay.

Admissions from Venereal Diseases in the three Presidencies,

Presidency.	Admissions per 1,000.						
	1860–69.	1870–79.	1880.	1881.	1882.	1883.	1884.
Bengal - -	265	209	276*	276*	271	281	291
Madras - - -	†	198	275	258	288	289	307
Bombay - -	†	194	269	261*	224	218	292
India - -	†	203	250	260	265	270	294

* Excluding troops in Afghanistan.
† The statistics of Madras and Bombay, and for the whole of India for these years are not available.

Primary and secondary syphilis gave rise to a larger proportion of admissions in the Madras Army than in the other two Presidencies, but gonorrhœa was more prevalent in he Bengal and Bombay armies than in that of Madras. Gonorrhœa was unusually prevalent in all three armies. In the following table the admission ratios for syphilis nd gonorrhœa in the three armies of India are compared with those of 1872:—

	Primary Syphilis.			Secondary Syphilis.			Gonorrhœa.		
	1884.	1872.	Difference.	1884.	1872.	Difference.	1884.	1872.	Difference.
Bengal Army -	86·7	61·9	+24·8	25·3	22·6	+2·7	147·5	87·2	+60·3
Madras „ -	101·7	65·4	+36·3	26·3	29·2	−2·9	135·8	61·5	+74·3
Bombay „ - -	89·7	54·4	+35·3	19·9	14·0	+5·9	142·3	75·7	+66·6

It will be seen that the results of the present year are in all cases with the single exception of secondary syphilis in the Madras Army less favourable, and often very considerably less favourable, than those of 1872.

Invaliding.

Throughout the Army of India, 1,757 men were invalided, or 31·74 per 1,000 of strength. This ratio is below those of the three preceding years, and 11·30 per 1,000 below the last decennial average. It is the second lowest ratio on record since 1870, the lowest having been 26·31 in 1880. The proportions of invalids contributed by the three Presidencies were remarkably even, differing from one another fractionally between 31 and 32 per 1,000.

Forty-one per cent. of the total number of men invalided in the Army of India were discharged as unfit for further service. This is a larger proportion than usual. The excess of invaliding for discharge over that for the previous year was due entirely to the greater numbers thus invalided from the Bombay Army, for in the Bengal Army the ratio was the same and in the Madras Army lower. The largest proportion of invaliding for discharge took place in the Bengal Army, and the least in the Bombay Army, the Madras Army being intermediate. The chief cause in each Presidency was as usual anæmia and debility. These give rise to an invaliding ratio of 4·03 in the Bengal Army, 7·88 in the Madras, and 7·84 in the Bombay Army. In the Bengal and Madras armies the next most prolific cause of invaliding was hepatitis 3·32 and 2·69 respectively. In the Bombay Army this ratio was only 1·66 per 1,000, whilst phthisis pulmonalis gave rise to the second highest invaliding ratio, namely, 3·14.

Invaliding due to mental diseases was noticed for the first time in the report for 1883, as the subject was one to which attention had been specially called. There is nothing further to note regarding this cause of loss to the army beyond what is there stated. It will suffice, therefore, to add the figures of 1884 to those already given in the following table:—

Total Cases of Mental Diseases.

Year.	Bengal.	Madras.	Bombay.	India.	Year.	Bengal.	Madras.	Bombay.	India.
1877 -	44	14	11	69	1881 -	39	18	18	75
1878 -	40	8	8	56	1882 -	48	15	14	77
1879 -	51	16	6	73	1883 -	54	19	13	86
1880 -	39	7	6	52	1884 -	58	18	12	88

In regard to invaliding with reference to age the per-centage of those under 25 years to whole number invalided was 38·70 throughout the Army of India. This is larger than that of the preceding year, namely, 36·55, which was itself unusually high. But the number of those invalided between 25 and 34 was smaller than in 1883, whilst for those from 35 years of age and upwards the ratio of 1884, namely, 17·64, was greater again than the ratio of 1883, which was 15·41. As regards the influence of length of service in India upon invaliding, a residence of from two to five years is the time during which the largest proportion of men break down. The per-centage of men under two years' service to the whole number invalided was considerably higher than during the two previous years (24·19 against 19·84 in 1883, and 17·35 in 1882); but this was more than compensated for by the reduction in the per-centage of men between two to five years invalided (49·97 against 57·81 in 1883, and 57·30 in 1882. The per-centage of men in the Army of India up to five years' residence during 1884 was 75, the same as in 1883, as against 72 in 1882. With gradual increase in the number of men of such service there was a corresponding increase in the proportion of men of that service invalided up to 1883. The result of 1884 shows a sudden check to this rising series of per-centages invalided, for whilst the army contained 75 per cent. of men under five years' service, the same as in 1883, yet the proportion invalided fell from 76·75 in 1883 to 74·16, nearly the same as it was in 1882 (74·65) when there were only 72 per cent. of such men.

The following table discloses unusual results, for it shows that the health of newly arrived soldiers was, on the whole, better than that of soldiers longer in the country :— Health of newly-arrived regiments.

Experience of newly-arrived Regiments in 1884 (*during their First Year of Indian Residence*).

—	Strength.	Ratio per 1,000 of Strength.							
		Admission-rate.	Daily Sick-rate.	Death-rate.	Deaths from				
					Enteric Fever.	Other Fevers.	Apoplexy.	Dysentery and Diarrhœa.	Hepatitis.
Army generally -	54,996	1513·4	67·0	12·56	2·74	0·64	1·09	0·47	1·11
New regiments -	3,861	1341·6	62·2	10·88	2·33	1·81	1·30	—	0·48

Both in respect of sickness and in mortality the ratios of newly-arrived regiments were more favourable than those of the army generally. In most years the reverse is the case, and in the report for the preceding year it will be seen that the admission and daily sick ratios of newly-arrived regiments were considerably in excess of the general rates, whilst the death-rate exceeded the general mortality of the army by 9·08 per 1,000. During 1883, however, a larger mortality among newly-arrived soldiers was attributed to enteric fever, namely, 8·95 per 1,000, whilst in 1884 only 2·33 of the total mortality was contributed by the same disease.

For the first time since 1875, a continuous decline in the numbers of women and children in the European Army of India has been checked. The rise in the number of women is, however, small; that in the number of children more considerable. The number of women was 3,371, among whom 59 deaths occurred, equivalent to 17·50 per 1,000, a favourable average, both as compared with that of the preceding year and the average of 1870–79, which was 25·09. Child-birth and abortion gave rise to the largest proportion of deaths, viz., to 2·97 per 1,000, almost identical with the average mortality from those causes during 1870–79, which was 2·93. The next most frequent causes of death were phthisis and apoplexy with sunstroke, which each gave rise to a mortality ratio of 1·78. Enteric fever gave rise to five deaths against three in 1883. Enteric fever, malarial fevers, apoplexy with sunstroke and respiratory diseases alone of the chief causes of mortality gave rise to higher death-rates than in 1883. The women of the Bengal Presidency suffered a considerably higher mortality than those of the Madras and Bombay Presidencies, the total death-rates being Bengal 22·53, Madras 10·56, and Bombay 12·21. Child-birth and abortion were the causes of greatest mortality in all three Presidencies. Sickness and mortality among women and children.

In the Army of India there were on an average 6,453 children. Among these 354 deaths occurred, equivalent to 54·86 per 1,000, a higher ratio than that of the preceding year (46·88), but below the average of the preceding ten-year period 1870–79, namely, 68·96. Diarrhœa was the most frequent cause of death, giving rise to a mortality of 11·47 against 8·48 in 1883. Convulsions came next with a mortality of 9·61 against 8·31 in 1883. Bronchitis and pneumonia also gave rise to a larger proportion of deaths than in 1883, namely, to 5·89 against 3·66, whilst anæmia and debility, dentition, and tabes mesenterica caused a smaller proportion of deaths. Measles appears to have been unusually prevalent, giving rise to an admission-rate of 50·4 per 1,000 against 14·0 in 1883 and to a death-rate of 3·72 against 0·33. The distribution of the total mortality among children of the Army of India in the three Presidencies was as follows:—Bengal 65·70, Madras 32·82, Bombay 53·88.

The total number of officers in the whole Army of India amounted to 5,647, of whom 2,718 belonged to the British Army and 2,929 to the Native Army. Among the officers of the British Army 33 deaths occurred, or 10·30 per 1,000, whilst among the officers of the Indian Army 28 deaths were reported, or 8·11 per 1,000. The combined ratio of mortality for both classes of officers together was 9·17. All these ratios are favourable when compared with the preceding three years. Mortality among officers.

Native Troops.

Sickness and mortality in 1884.

The health of the native army of India, as a whole, was very favourable during 1884. Sickness was certainly somewhat more prevalent than in the preceding year, as both the admission and daily sick-rates were greater; but as the mortality from all causes was less, the type of sickness must have been of a less severe character. The admission and daily sick-ratios, 1,042 and 33 per 1,000 respectively, are but little in excess of those of the very favourable year 1877, and they are both below the quinquennial averages of 1877–81. The total mortality-ratio 10·50 is extremely favourable, being the lowest on record since 1877, when the results for the whole army of India were for the first time brought together. This ratio is also below that of the European army of India, namely, 12·56, and is almost a third of the total mortality in the jails of India, which was 29·11. Cholera was but little prevalent among these troops, and but for this the total mortality from all causes would not have been so favourable as that of 1877, for omitting the deaths due to this cause from both years, the result of 1877 would be fractionally more favourable than that of the year under report.

Sickness and Mortality during the years 1877 *to* 1884 *compared.*

Year.	Average Strength.	Ratio per 1,000.				Mortality, including absent Deaths.
		Admissions into Hospital.	Daily Sick.	Deaths from		
				Cholera.	All Causes.	
1877–81	118,669	1,422	48	1·94	24·90	27·40
1877	113,966	1,030	32	1·53	10·90	13·38
1878	117,273	1,460	43	2·06	18·04	21·02
1879	121,107	1,735	58	4·61	35·15	37·79
1880	126,385	1,545	56	0·53	39·22	41·12
1881	114,612	1,305	46	0·97	19·24	22·62
1882	114,894	1,129	37	1·02	12·24	14·76
1883	114,830	923	31	1·15	11·76	14·31
1884	114,827	1,042	33	0·71	10·50	12·22

Malarial fevers were of course the most usual causes of admission into hospital, giving rise to 503·2 per 1,000 of admissions against 387·4 in 1883. Compared with the preceding year almost all the chief causes of admission gave rise to higher ratios; but cholera, small-pox, venereal diseases, abscesses with ulcers and wounds with accidents gave rise to somewhat smaller ratios. Bowel complaints and respiratory diseases were less prevalent than usual, although somewhat more so than during 1883. Enteric fever gave rise to the same proportionate number of admissions as during the past three years, but the disease was much more fatal, for of those treated 61·11 per cent. died. During 1883 the per-centage of deaths among those attacked was the lowest on record since 1877, and the next highest ratio to that of the year under report was 58·33 in 1882. In actual numbers these ratios mean that of 18 patients treated during 1884, 11 died. The chief cause of mortality in the native army is usually respiratory disease, and during 1884 it caused 2·97 per 1,000 of the total mortality. This ratio is below the average of late years, which, however, was unduly raised by the high ratios which prevailed during 1879 and 1880, years of active warfare. Next to respiratory diseases fevers contributed most largely to mortality (1·80 per 1,000), and next in order cholera (0·71), dysentery (0·70), phthisis (0·64), and diarrhœa (0·44).

Bengal Army.

Sickness in the Bengal Army was less prevalent than usual. The admission-ratio, 1,193 per 1,000, is considerably greater than it was during 1883, but the ratio of that year was unusually low. In the following table it will be observed that the ratio of 1884 is less than the last decennial average, 1,360. The daily average sick-ratio, 35 per 1,000, is not unfavourable:—

Year.	Average Strength.	Ratio per 1,000.				Mortality, including absent Deaths.
		Admissions into Hospital.	Daily Sick.	Deaths from		
				Cholera.	All Causes.	
1867–76	39,508	1,360	42	2·12	13·84	17·25
1877	39,649	1,097	34	0·35	10·32	13·63
1878	41,116	1,645	49	2·09	22·59	25·57
1879*	31,116	2,023	68	2·80	31·78	53·61‡
1880*	30,365	1,609	65	1·52	33·85	53·15‡
1881*	36,899	1,495	51	0·92	19·76	27·93†
1882	40,256	1,250	41	0·72	13·34	16·49
1883	40,932	985	32	0·56	10·55	13·98
1884	40,850	1,193	35	0·71	10·97	12·56

* Excluding troops in Afghanistan.
† These ratios are calculated on the total regimental strength, including the army in Afghanistan.

Although sickness was more prevalent than in 1883, the total mortality from all causes did not rise proportionately but remained almost as low as the favourable ratio of that year. Bowel complaints were considerably more prevalent than in 1883, the ratios of admissions having been 99·1 and 67·0 respectively, but abscesses and ulcers gave rise to a diminished admission-ratio, namely, 96·5 against 114·0. Fevers gave rise to a higher mortality than in the preceding year, namely, to 2·40 per 1,000 against 1·62. Dysentery, cholera, anæmia, and wounds and accidents also contributed more largely to mortality than in the preceding year. Of cholera, 41 cases were treated, of which 29, or 70·73 per cent., terminated fatally.

The proportions in which the various geographical sections of the army contributed to the general admission and death-rate are shown in the following table:—

Year.	Ratio per 1,000.									
	Bengal Proper and Assam.		Gangetic Provinces.		Rohilkund and Meerut.		Agra and Central India.		Punjab.	
	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.
1867–76	1,523	19·13	1,062	8·38	987	11·19	1,588	9·61	1,459	14·24
1877	1,492	19·64	768	5·19	942	9·52	906	7·41	1,243	8·85
1878	1,527	22·13	1,036	7·88	1,008	9·83	1,581	12·96	1,896	18·33
1879	1,816	25·57	1,658	11·05	2,038	36·17	2,303	16·07	2,173	47·64
1880	1,757	40·63	1,222	20·50	1,395	24·46	1,884	28·52	1,687	38·02
1881	1,772	22·53	1,260	15·78	1,378	15·67	1,380	9·35	1,521	22·86
1882	1,569	18·22	1,081	10·01	1,683	9·98	1,248	7·18	1,268	13·30
1883	1,408	16·23	970	8·17	978	11·53	906	5·77	830	10·80
1884	1,367	14·61	929	6·00	1,188	10·62	1,312	7·84	1,083	8·49

Sickness was most prevalent in Bengal and Assam and Agra and Central India and least prevalent in the Gangetic Provinces and Punjab. In all groups excepting the Rohilkund and Meerut the admission-ratios of the year are below the averages of 1867–76. The ratios in the last-mentioned group have been above the decennial average since 1878, with the single exception of 1883. As regards mortality, the most favourable results were recorded in the Gangetic Provinces and Agra and Central India groups and the worst in Bengal and Assam. In all groups the ratios of 1884 are below the averages of the last decade.

The chief causes of sickness in the various geographical groups are set forth in the following table:—

Groups.	Ratio of Admissions per 1,000 of Strength.					
	Fevers.	Bowel Complaints.	Spleen Diseases.	Respiratory Diseases.	Rheumatism.	Abscess and Ulcer.
Lower Bengal and Assam	593	204	11	75	55	80
Gangetic Provinces	346	63	8	48	46	120
Rohilkund and Meerut	530	69	17	46	39	101
Agra and Central India	836	56	8	45	33	95
Punjab	629	49	8	44	27	87

Compared with the ratios of 1883 fevers were more prevalent in every group except the Bengal-Assam group. The excess was slight in the Gangetic Provinces, and Rohilkund—Meerut groups, but was considerable in the Agra—Central India and Punjab groups. Bowel complaints gave rise to higher ratios in every group but especially in the Bengal-Assam, Rohilkund—Meerut and Agra—Central India groups. Spleen diseases were less prevalent only in the Punjab group; in the Rohilkund—Meerut group the ratio is almost six times greater than in 1883, when it was only 3 per 1,000. Respiratory diseases were, on the whole, prevalent to the same extent as in 1883; in Rohilkund—Meerut the ratio of 1884 exceeded the ratio of the preceding year most, namely, by 8 per 1,000. Rheumatism was more prevalent in Bengal-Assam and Rohilkund—Meerut and less prevalent in Gangetic Provinces and Punjab. Abscesses and ulcers were less prevalent in all groups except the first, where the excess in the admission-rate was but nominal, 1 per 1,000.

The chief causes of mortality in the several geographical groups in the Bengal Army are shown in the following table:—

Groups.	Ratio per 1,000.				
	Cholera.	Fevers.	Bowel Complaints.	Respiratory Diseases.	Total.
Lower Bengal and Assam	1·76	2·99	2·11	2·11	14·61
Gangetic Provinces	0·67	1·07	—	1·74	6·00
Rohilkund and Meerut	0·49	2·51	0·97	1·93	10·62
Agra and Central India	1·06	2·12	1·06	0·35	7·84
Punjab	—	2·31	0·75	2·78	8·49

Cholera gave rise to a somewhat smaller ratio of mortality in the first group than in 1883, but in the Gangetic Provinces and Rohilkund—Meerut groups the reduction over the previous year's ratios was pronounced. In the Punjab there was no mortality from cholera, and in the preceding year only one death was registered from this cause. The Agra—Central India group registered a mortality of 1·06 per 1,000 against none in the two preceding years. Fevers were less fatal in the second group than in 1883, but the reduction in the present year's ratio was slight. In the remaining groups the ratios were higher, and the excess in the case of the Agra—Central India and Punjab groups was pronounced, as the ratios of 1883 were 0·99 and 0·79, respectively, against 2·12 and 2·31 in 1884. Bowel complaints were more fatal in the Rohilkund—Meerut and Agra—Central India groups than in 1883, but in the Bengal-Assam and Gangetic Provinces they were less so, whilst the mortality-ratio in the Punjab was much the same. It is satisfactory to note that respiratory diseases gave rise to smaller mortality-ratios in every group, but specially in the Punjab, where the ratio of 1884 was about one-half that of 1883.

Of the stations occupied throughout the year, only one, Dhuki and Gumbuz, with an average strength of 278 men, recorded an admission-rate above 2,000 per 1,000. Twelve stations recorded rates varying from 1,500 to 2,000 against only five in 1883; Baxa, Banda, Delhi, Mooltan, and Mecan Meer were prominent among these, all with ratios exceeding 1,700 per 1,000.

Five stations occupied throughout the year by the regular troops of the Bengal Army recorded mortalities exceeding 20 per 1,000 against 4 in 1883. The stations are, Dhuki and Gumbuz 68·35, Dibrugarh 25·71, Dehra Dun 25·27, Alipore and Baliganj 24·24, Shillong and outposts 21·08.

In Dehra Dun the average strength was 554, and 14 deaths gave rise to the ratio quoted; four of these were due to fevers and four to phthisis. At Dibrugarh the average strength was 739 and 19 deaths occurred; four due to fevers and two to each of the following—dysentery, respiratory diseases, phthisis, and anæmia. At Alipore and Baliganj, out of a strength of 825, 20 deaths took place; cholera, intermittent fevers, and respiratory diseases caused three each, and remittent and continued fevers, dysentery, and diarrhœa each two. At Shillong there was an average strength of 664 men and 14 men died; cholera caused three and diarrhœa and phthisis each two deaths.

Thirteen regiments or detachments of the regular army of Bengal suffered a mortality exceeding 20 per 1,000, and of them five were serving in Bengal, Assam and Bhootan, and four in Southern Afghanistan. The 12th Bengal Infantry at

Cachar and its outposts recorded a mortality of 30·23 per 1,000. This regiment arrived in 1881 from Agra. Twenty-four men died. The 42nd Bengal Infantry at Dibrugarh and its outposts, a local regiment, which arrived at this station from the Naga Hills in January 1883, suffered a loss of 25 men, or 29·52 per 1,000. Only one regiment in the Rohilkund and Meerut group comes under this category, namely, the 22nd Bengal Infantry at Delhi; but it arrived there in the course of the year from Meean Meer. It lost 17 men, equivalent to 20·91 per 1,000. Five of the deaths of men present with their regiments were due to fevers and eight to pneumonia and pleurisy. In the Agra and Central India group one regiment, the 40th Native Infantry at Jhansi, lost 18 men, or 22 per 1,000. It arrived at this station in December 1883, from Barrackpore. Three deaths were from cholera and six from fevers. Among the regiments in the Punjab, the 45th Rattray's Sikhs at Jhelum (head-quarters in Southern Afghanistan for half the year), and the 1st Native Infantry (head-quarters, for 3½ months in Afghanistan) are the only regiments with a mortality exceeding 20 per 1,000. The former lost 18 men and the latter 22 (13 from pneumonia and pleurisy). Of the regiments in Southern Afghanistan, the 10th Bengal Cavalry lost 15 men, equivalent to 27·83 of strength. A detachment of Sappers and Miners lost 30 men, equivalent to 66·52 per 1,000 of strength. Fevers, respiratory diseases, and bowel complaints were the principal causes.

The health of the Punjab Frontier Force was very favourable. Admission, daily sick, and death rates were all the lowest on record since 1877. More than one-half of the total admission-ratio was contributed by fevers. It is satisfactory to note a considerable reduction in the admission-rate for respiratory diseases, which was 72 per 1,000 against 109 in 1883. The ratio of 1884 is still, however, above the average of 1867–76 which was 66. The actual number of deaths from respiratory diseases was 54, equivalent to 5·16 per 1,000 of the average strength of the force, viz. 10,458, against 148, or 14·18 in 1883. The largest number of admissions were made in Dera Ismail Khan (1,572) and the lowest in Abbottabad (748). The highest mortality was recorded in Dera Ghazi Khan (20·05), the lowest in Abbottabad (5·63). Of individual regiments in this force, the 4th Punjab Infantry at Dera Ghazi Khan (head-quarters for three months on the Zhob Valley expedition) suffered the largest mortality, namely, 26·96 per 1,000. This represents 22 deaths, seven of which among those present at head-quarters were due to pneumonia and pleurisy. The 5th Punjab Infantry at Dera Ismail Khan also suffered a high mortality ratio, viz., 20·99, representing 17 deaths. Next come the 3rd Punjab Cavalry at Rajanpur with 10 deaths and the 3rd Sikh Infantry at Kohat with 15 deaths.

The health of the Central India regiments during the year under report was very favourable in every respect, but especially in the small death-rate of 7·23 per 1,000 of an average strength of 5,082. Thirty deaths occurred in all, 12 of which were due to respiratory diseases. Judging from the admission-ratios in the several stations occupied by these regiments, Kherwarah and Erinpoorah were the most unhealthy, each with ratios above 900 per 1,000, and Goona and Deoli the most healthy. The highest death-rate was recorded in Agar (10·36) and the lowest in Kherwarah (1·62). The Mhairwarra Battalion at Ajmere suffered the greatest mortality, 11·13, representing eight deaths, four of which among those present with their regiments were due to pneumonia and pleurisy. The 1st Central India Horse lost five men (10·22 per 1,000). The Meywar Bheel Corps at Kherwarah lost only one man from pneumonia out of those present with their regiments.

The health of the troops of the Hyderabad Contingent is usually extremely favourable, and during 1884 the vital statistics of the force maintained their favourable character. There were in all 32 deaths (4·56 per 1,000 of average strength of 7,014), two of which were due to cholera. The admission-rate was highest in Jaina (928) and Ellichpur (785), and lowest in Bolarum (250) and Raichore (380). The 5th Infantry at Ellichpur lost six men and the 4th Infantry at Bolarum seven men, whilst the 3rd Cavalry, 2nd Cavalry, and No. 1 Field Battery lost one each. The 2nd and 4th Field Batteries and the 1st Cavalry lost none.

Madras Army.

The health of the Madras troops was on the whole very favourable. The admission and death-rates were among the most favourable on record. Cholera gave rise to 80 admissions against 173 in 1883. Of the former number 41 died, equivalent to 51·25 per cent. of those attacked against a ratio of 46·82 in the preceding year. Small-pox gave rise to 100 admissions, of which six only proved fatal. The corresponding numbers of the preceding year were 77 and 4.

Sickness and Mortality during the last Eight Years compared.

Year.	Average Strength.	Ratio per 1,000.				Mortality, including absent Deaths.
		Admissions into Hospital.	Daily Sick.	Deaths from		
				Cholera.	All Causes.	
1877	23,304	861	28	2·79	11·80	14·36
1878	25,728	841	29	2·23	12·25	15·49
1879	27,314	1,269	43	3·19	18·89	21·23
1880	28,710	1,399	54	0·10	15·57	19·54
1881	28,533	997	41	1·37	12·02	16·75
1882	27,654	879	30	2·64	12·01	14·99
1883	27,703	737	27	2·92	10·76	12·51
1884	25,059	836	31	1·46	10·02	11·82

Of the large stations in the Madras Presidency with an average strength exceeding 1,000 men, Secunderabad recorded the highest admission-ratio, namely, 1,416 per 1,000, and next to it Madras (606), Bangalore (520), Bellary (512), Trichinopoly (483), and Kamptee (457). The highest mortality was recorded in Toungoo (22·88), and the next at Secunderabad (18·55). Deaths in Toungoo were due to various causes, but none to cholera; whilst at Secunderabad, of the 64 deaths which gave rise to the above-mentioned ratio, 27 were due to this cause. At Bangalore, where the largest native force is quartered, the total mortality was 6·27, 22 deaths giving rise to it. Of individual regiments the 11th Native Infantry at Secunderabad suffered the largest mortality in proportion to their numbers. This regiment arrived in April from Rangoon and lost in all 34 men, equivalent to 37·99 per 1,000. Thirteen deaths were due to cholera and eight to dysentery and diarrhœa. The 1st Madras Native Infantry also suffered heavily. The regiment was serving in Southern Afghanistan, and was on the march to and at Bangalore for a month and a half of the year. It lost 27 men, equivalent to 33·75 per 1,000 of strength. None of the deaths were due to cholera, but 18 were caused by pneumonia and pleurisy. The 3rd Madras Native Infantry at Toungoo lost 26 men (33·25 per 1,000).

Bombay Army.

The health of the Bombay Army was not so favourable as it had been during the two previous years. Sickness was more prevalent and mortality somewhat greater.

Sickness and Mortality during the last Eight Years compared.

Year.	Average Strength.	Ratio per 1,000.				Mortality, including absent Deaths.
		Admissions into Hospital.	Daily Sick.	Deaths from		
				Cholera.	All Causes.	
1877	23,388	1,074	33	1·93	10·90	12·96
1878	23,672	1,702	45	2·36	15·12	17·95
1879	22,854	1,663	54	3·11	20·22	21·99
1880*	15,328	1,283	45	—	10·44	56·53‡
1881*	18,349	1,166	41	1·85	14·01	25·93‡
1882†	23,772	1,067	36	0·46	12·16	13·41
1883	23,576	994	35	0·47	12·81	14·96
1884	23,373	1,153	38	0·39	12·96	14·35

* Excluding Afghanistan. † Including troops in Southern Afghanistan.
‡ These ratios are calculated on the total regimental strength, including the army in Afghanistan.

Fevers gave rise to a considerably higher admission-ratio than in 1883, viz., to 570 per 1,000 against 399. Respiratory diseases were also more prevalent, but mortality from them was reduced. Bowel complaints were more fatal than in 1883; they gave rise to 40 deaths, equivalent to 1·71 per 1,000 of strength, against 22 deaths, or 0·94, in 1883. It is satisfactory to observe that scurvy gave rise to only four deaths against 14 in 1883.

Sickness was most prevalent in the stations occupied in Southern Afghanistan and the Persian Gulf. At Dhuki, Gundakindoff, and Bolan Pass the admission-rates were between 3,073 and 4,433 per 1,000. These high ratios were mainly contributed to by fevers, bowel complaints, and respiratory diseases. Of the larger stations with over 1,000 men the most unhealthy were Quetta (admission-rate 1,565 per 1,000) and Jacobabad (1,493), whilst the most healthy were Belgaum (410) and Poona (706). In regard to mortality in individual stations, the highest rates on the whole prevailed also in the Southern Afghanistan stations, notably at Dhuki, where the ratio was 42·84. Respiratory diseases were the chief causes of death. The 12th Bombay Native Infantry at Pishin and its outposts suffered a heavier mortality than any other regiment, namely, 66·19 per 1,000, representing 55 deaths, due mostly to respiratory disease, bowel complaints, and fevers. The 3rd Native Infantry also at Dhuki suffered much, having lost 39 men. The 26th Native Infantry at Quetta lost 32 men. The 2nd Sind Horse, a local corps at Jacobabad, lost 25·64 per 1,000 of its strength.

Having considered individually the health statistics of the several portions of the Native Army of India in the foregoing paragraphs, it will now be convenient to contrast the main features of each, and, for convenience, the chief results are brought together in the following table:—

Presidency.	Total Deaths per 1,000 including Absentees.	Average Strength present with Regiments.	Ratio per 1,000.			
			Admissions into Hospital.	Daily Sick.	Deaths from Cholera.	Deaths from all Causes.
Bengal Native Army	12·56	40,850	1,193	35	0·71	10·97
Madras " "	11·82	28,050	836	31	1·46	10·02
Bombay " "	14·35	23,373	1,153	38	0·39	12·96
Central India Regiments	7·23	5,032	644	20	0·20	5·90
Punjab Frontier Field Force	14·06	10,458	1,262	36	—	10·71
Hyderabad Contingent	5·30	7,014	574	19	0·29	4·56
India	12·22	114,827	1,042	33	0·71	10·50

As usual, the Central India regiments and the Hyderabad Contingent show the most favourable results both as regards sickness and mortality from all causes; for the admission, daily sick, and death-ratios of these forces are the lowest of the series given in the table. The highest admission-rates prevailed in the Punjab Frontier Force and the regular Native Army of the Bengal Presidency. The highest average daily sick-ratio was recorded in the Bombay Army and in the Punjab Frontier Force. The highest death-rates were registered in the Bombay and Bengal Armies. In the Madras Army and Punjab Frontier Force the total death-ratios were nearly alike.

Jails.

Sickness and mortality in 1884.

The average number of prisoners confined in jails throughout India was considerably less than of late years. Sickness among them estimated by the admission and daily sick rates was somewhat greater than it had been during the previous year, but less than in the three years preceding 1883. Notwithstanding this slight increase of sickness the death-rate from all causes fell from 31·37 per 1,000 during the previous year to 29·11. This is the lowest death-rate on record, being less than the average death-rate during 1872–76 by 7·13 per 1,000, and less than that during 1877–81 by 33·9. The latter quinquennial period it should be borne in mind included the famine period. This satisfactory diminution in the total death-rate is mainly due to the lessened mortality from bowel complaints, which was 9·73 per 1,000 against 13·48 in the five-year period 1872–76 and 24·97 during the succeeding five years. It is noteworthy that the admission-rate from these diseases was somewhat greater during the year under report as compared with that of the previous year, namely, 175·2 per 1,000 against 164·5 in 1883. The mortality due to cholera, 1·43 per 1,000, was also below the average. The death-rate from small-pox though small was more than twice what it had been during the previous year, namely, 0·29 per 1,000 against 0·11.

Statement showing the Strength, Sickness, and Mortality among the Prisoners of India during the years 1872–76, 1877–81, *and the years* 1880 *to* 1884.

Year.	Average Strength.	Ratio per 1,000.				
		Admissions into Hospital.	Daily Sick.	Deaths from		
				Cholera.	Dysentery and Diarrhœa.	All Causes.
1872–76	99,758	1,016	2	2·86	13·48	36·24
1877–81	112,670	1,189	44·9	4·48	24·97	63·01
1880	106,763	1,213	46	0·74	19·43	48·31
1881	100,844	1,214	45	3·03	16·92	44·03
1882	94,063	1,214	42	2·75	15·21	39·96
1883	88,174	996	36	2·28	10·64	31·37
1884	85,496	1,025	37	1·43	9·73	29·11

It has already been noted that the average number of prisoners confined throughout India was less than it had been during the previous year. The decline in the numbers confined has been continuous since 1880, and during 1884 the average number of prisoners was less than the approximate average number during the 10 years 1872–81 by 20,718. The proportion of prisoners to the general population was 4·3 per 10,000 against 4·5 in 1883 and 4·6 in 1882. For the several Presidencies, the ratios are given in the following table:—

Ratio of Prisoners per 10,000 *of Population in each of the three Presidencies for* 1884, 1883, 1882, 1881, 1878, *and* 1872–76 *compared.*

Presidency.	Period.	General Population according to Census of 1881.	Prisoners.		
			Average Number.	Proportion to 10,000 of Population.	Deaths per 1,000 of average Strength.
Bengal	1872–76	47,215,384	68,328	4·6	39·39
	1878		78,116	5·3	65·85
	1881		63,478	4·3	44·42
	1882		59,489	4·0	42·56
	1883		54,982	3·7	34·28
	1884		51,877	3·5	32·71
Madras	1872–76	31,170,631	9,607	3·1	32·37
	1878		21,315	6·8	125·92
	1881		10,332	3·3	41·91
	1882		8,752	2·8	42·62
	1883		7,666	2·5	29·87
	1884		6,959	2·2	20·55
Bombay	1872–76	16,454,414	8,011	4·9	26·61
	1878		13,139	8·0	118·27
	1881		9,910	6·0	41·88
	1882		8,845	5·4	33·35
	1883		7,806	4·7	34·33
	1884		7,305	4·4	34·91

Sickness was more prevalent in the jails of the Bengal Presidency than in those of the other two Presidencies, as shown in the following table:—

Presidency.	Average Strength.	Ratio per 1,000.				
		Admissions into Hospital.	Daily Sick.	Deaths from		
				Cholera.	Dysentery and Diarrhœa.	All Causes.
Bengal	51,877	1,028	34	1·52	12·66	32·71
Madras	6,959	765	29	1·01	6·18	20·55
Bombay	7,305	702	26	0·55	7·94	34·91

The total mortality in the Bengal Presidency (32·71) was, however, not so great as it was in Bombay (34·91). The total mortality amongst the Madras prisoners (20·55) was the least, and is very satisfactory when taken in connexion with the greater prevalence of sickness among them as compared with the Bombay prisoners whose mortality was greatest. Cholera caused a smaller proportion of deaths in all three Presidencies than in the previous year; but the disease was remarkably quiescent in the jails of the Bombay Presidency. Bowel complaints were most fatal in the Bengal Presidency and least so in the Madras Presidency, where they caused only about half the mortality of the preceding year.

It has already been remarked that sickness in the jails of the Bengal Presidency was somewhat more prevalent during the year under report than it had been during the previous year, which, however, was one of exceptional results as compared with recent years. Still the admission and average sick ratios were below the averages of the five-year period 1877–81, and below those of individual years from 1878 to 1882 inclusive. The continued decline in the mortality from bowel complaints is the most satisfactory feature of the medical history of these jails. The death-rate from these diseases during the year 1884, namely, 12·66, is amongst the lowest on record. The mortality from cholera was unusually small. The total mortality from all causes (32·71) is a remarkable improvement upon that of most years: it is indeed the third lowest on record.

Year.	Average Strength.	Ratio per 1,000.				
		Admissions.	Daily Sick.	Deaths from		
				Cholera.	Bysentery and Diarrhœa.	All Causes.
1877–81	62,249	1,345	46	3·99	22·33	65·40
1877	63,300	967	30	3·07	10·59	31·88
1878	58,416	1,182	41	6·34	23·27	65·36
1879	73,901	1,335	46	6·38	30·65	77·99
1880	66,751	1,103	40	1·00	21·51	51·12
1881	63,478	1,352	41	3·10	17·21	44·42
1882	59,489	1,178	40	3·11	17·31	42·56
1883	54,862	949	32	2·35	12·93	34·28
1884	51,877	1,028	34	1·52	12·66	32·71

Fevers were more prevalent than they were during the preceding year; but the admission-rate was below the decennial average of 1873–82. Of the chief diseases enumerated in the following table causing admission into hospital four only were more than ordinarily prevalent, as compared with decennial averages. These are dysentery, diarrhœa, anæmia with debility, and venereal diseases. The type of the bowel diseases prevalent must, however, have been mild since mortality from them was considerably less than usual.

Number.	Diseases.	Decennial Average, 1873–82.	Admitted per 1,000 of Average Strength.										
			1884.	1883.	1882.	1881.	1880.	1879.	1878.	1877.	1876.	1875.	1874.	1873.
1	Fevers	488	452	389	541	528	458	660	556	371	457	398	445	450
2	Abscess and ulcer	116	94	102	123	127	133	174	113	122	115	99	107	110
3	Dysentery	112	117	100	117	105	116	129	137	98	104	96	101	110
4	Diarrhœa	103	106	100	108	106	117	112	107	94	86	90	96	108
5	Respiratory diseases	44	36	39	45	48	48	21	45	43	41	37	45	44
6	Wounds and accidents	41	35	36	39	40	37	36	43	48	39	43	44	43
7	Atrophy and anæmia	23	28	27	28	28	28	29	28	24	19	16	15	19
8	Venereal diseases	17	18	18	21	20	20	18	18	15	12	21	16	12
9	Rheumatism	17	15	16	16	15	15	15	16	21	17	16	19	17
10	Eye diseases	13	13	13	15	13	14	11	13	12	11	11	12	13
	Total of the Ten	973	915	840	1,053	1,030	986	1,166	1,076	848	901	827	900	927
	Total from all Causes	1,091	1,028	949	1,178	1,151	1,108	1,285	1,182	967	1,017	943	1,028	1,043

The following table gives the death ratios from the diseases which have been the chief causes of mortality since 1873:—

Number.	Diseases.	Decennial Average, 1873–82.	Died per 1,000 of Average Strength.										
			1884.	1883.	1882.	1881.	1880.	1879.	1878.	1877.	1876.	1875.	1874.	1873.
1	Dysentery and diarrhœa	18·90	12·66	12·93	17·31	17·91	21·51	30·65	28·27	10·59	14·75	12·38	16·38	16·68
2	Respiratory diseases	7·18	6·03	6·00	7·26	7·52	9·38	9·53	8·32	5·41	5·45	5·01	6·02	7·00
3	Fevers	5·29	2·16	2·38	3·53	4·65	4·45	13·82	7·14	1·97	2·36	4·20	3·72	5·47
4	Cholera	3·46	1·52	2·35	3·11	3·10	1·00	6·33	5·34	3·07	4·24	2·35	2·48	2·97
5	Atrophy and anæmia	3·10	2·10	2·02	3·64	2·58	3·66	5·43	5·01	2·69	2·19	1·65	2·37	1·94
6	Phthisis pulmonalis	2·50	2·12	2·31	1·98	2·24	2·53	3·00	2·76	2·36	3·24	1·86	2·51	2·33
7	Dropsy	0·80	0·85	0·80	0·88	0·68	1·05	0·99	0·83	0·71	0·73	0·67	0·85	0·55
8	Wounds and accidents	0·68	0·46	0·44	0·62	0·55	0·63	0·66	0·95	0·75	0·52	0·62	0·69	0·78
9	Apoplexy	0·66	0·52	0·60	0·30	0·58	0·88	0·76	1·02	0·80	0·59	0·52	0·31	0·81
10	Spleen diseases	0·35	0·27	0·34	0·19	0·22	0·57	0·31	0·23	0·20	0·29	0·77	0·37	0·23
	Total of the Ten	42·91	28·69	30·17	38·22	40·13	45·66	71·53	60·63	28·55	34·36	30·03	35·70	38·76
	Total from all Causes	47·36	32·71	34·28	42·56	44·42	51·12	77·90	65·85	31·88	37·51	33·65	39·90	43·08

It is very satisfactory to observe in this table that the diminished total death-rate was due to a diminished death-rate from every one of the chief causes of mortality with the single insignificant exception of mortality from dropsy which increased from 0·80 per 1,000, the decennial average, to 0·85 in the year under report. The most marked reduction of mortality occurred in the cases of bowel complaints, fevers, and cholera. The fever mortality is the second lowest on record since 1865, the lowest having occurred during 1877, when it was 1·97 per 1,000. Although the death-rate from respiratory diseases was below the average of the decennial period, it is still far from satisfactory when compared with the results of individual years since 1859, as the result of 1884 is worse than the results of 19 previous years. With greater attention to suitable clothing, mortality from this cause should certainly be lowered.

Sickness was most prevalent in Lower Bengal and Assam, where the admission-rate was 1,586 and the daily sick-rate 55 per 1,000, and least so in the Gangetic Provinces and Oudh, where these ratios were 629 and 24 respectively. These last ratios were very nearly approached by those of the Agra and Central India Jails, where the admission-rate was 640 and the daily sick-rate 24. The Rohilkund with Meerut and Punjab groups were much the same as regards the prevalence of sickness, for, whilst in the latter group the daily sick ratio was smaller than it was in the Rohilkund and Meerut group, the admission-rate was greater. The Central Provinces group would come fourth in point of high admission and daily sick ratios. With regard to mortality a reference to the last column of the following table shows a most satisfactory diminution in all groups in the total death-rate of the year as compared with the average mortality during 1877–81. The diminution in the Punjab is especially striking—60·09 per 1,000 less than the five years' average. Cholera was on the whole less prevalent than usual. It caused the largest proportion of deaths in the first group. The disease was unusually fatal in the fifth group. During the year 1884, as in the preceding two years, no death from this disease was registered in the sixth group. The disease was remarkably in abeyance in the Central Provinces, the death-rate having been only 0·44 against a ratio above 4 per 1,000 during the two preceding years, and an average mortality of 11·39 during the five years 1877–81. Deaths from bowel complaints were as usual most numerous in the Lower Bengal group, but it is disappointing to find the mortality for the year under review greater than that of the previous one. In every group, however, the mortality was below the quinquennial average.

Statement showing Sickness and Mortality amongst the Prisoners of the Bengal Presidency (arranged in Groups in accordance with their Geographical Positions) from 1877–81, 1882, 1883, *and* 1884.

Groups.		Average Strength.	Ratio per 1,000.					
			Admissions into Hospital.	Daily Sick.	Deaths from			Difference between Average Mortality and Year's Mortality.
					Cholera.	Dysentery and Diarrhœa.	All Causes.	
I.—Lower Bengal and Assam	1877–81	14,788	1,519	50	7·43	31·63	67·50	
	1882	13,327	1,693	54	8·25	25·44	59·95	−9·79
	1883	12,414	1,630	53	4·03	22·64	52·52	
	1884	12,250	1,586	55	4·24	25·06	57·71	
II.—Gangetic Provinces and Oudh	1877–81	22,769	695	25	3·21	13·98	38·29	
	1882	13,515	724	28	3·19	14·36	33·70	
	1883	16,846	616	23	3·32	8·67	25·76	−12·24
	1884	15,822	629	24	0·88	8·91	21·05	
III.—Central Provinces (excluding Jubbulpore and Saugor)	1877–81	3,002	983	36	11·39	26·11	69·88	
	1882	2,833	1,106	48	4·24	49·42	89·66	
	1883	2,609	1,003	41	4·22	60·56	88·54	−24·73
	1884	2,259	902	34	0·44	22·13	45·15	
IV.—Agra and Central India	1877–81	5,338	1,063	49	2·89	17·16	51·33	
	1882	4,513	763	28	0·89	6·65	27·92	
	1883	4,359	556	21	2·75	6·19	21·56	−31·44
	1884	4,224	640	24	0·24	7·34	19·89	
V.—Rohilkund and Meerut	1877–81	9,072	935	40	0·35	15·30	37·59	
	1882	7,187	1,007	38	—	7·65	25·46	
	1883	6,627	753	31	—	3·62	18·26	−11·99
	1884	6,054	1,074	34	1·82	7·93	25·60	
VI.—Punjab	1877–81	14,180	1,674	51	2·38	31·64	88·13	
	1882	13,115	1,546	45	—	15·25	41·63	
	1883	12,128	951	27	—	6·18	29·11	−60·09
	1884	11,268	1,131	27	—	7·10	28·04	

The health of the prisoners in Lower Bengal was on the whole favourable. The admission-rate fell from 1,498 during the previous year to 1,420, which ratio compares favourably also with the average of the preceding five-year period, namely 1,457. The average number of daily sick remained the same as it had been during 1883, namely 50, a higher number than the average of the preceding five years. Cholera caused 4·06 of the total mortality; this is a smaller proportion than usual. The marked reduction in the mortality from bowel complaints, which occurred during 1883, was maintained, and even improved upon, during 1884, the death-rate having been 22·83 against 23·44 in 1883, and an average ratio of 32·94 during the period 1877–81. The admission and death-rates from fevers were 473 and 224 per 1,000 respectively. The death-rate from fevers during 1884 was the lowest for nine years. Admissions from bowel complaints (497 per 1,000) were more numerous than they were in most of the preceding years, yet the mortality due to them continued to fall since 1878, and in 1884 was 22·83 per 1,000.

The highest admission-rates prevailed in the Khoolna (4,473 per 1,000) and Darjeeling (3,283) Jails. The average number of prisoners, however, at each of these jails, 74 and 99 respectively, was small, and the ratios per 1,000 do not convey any real measure of unhealthiness. Confining attention to jails with an average number of prisoners exceeding 500, the highest admission-rates were recorded in the following jails:—Alipore 2,009, Dacca 1,487, Presidency (Natives) 1,386, Midnapore 1,292, and Rajshahye 1,028. The ratios for the Alipore, Presidency, and Midnapore Jails were below those of the preceding year. In the remaining two jails coming under this category, Bhagalpur Central Jail and Buxar, the rates were comparatively low, namely, 650 and 746 per 1,000 respectively. Fevers gave rise to the largest proportion of admissions in the Khoolna, Pooree, Soory, and Chybassa Jails, in all of which the admission-rate exceeded 1,000 per 1,000. Remittent and continued fevers were remarkably prevalent in the Dacca Jail. Dysentery and diarrhœa were most prevalent in the Khoolna, Bogra, Mymensingh, Chumparun, Furreedpore, Rungpore, and Pooree Jails—all above 1,000. The highest mortality was recorded in the Rungpore Jail (256·52). This is the only jail with a mortality exceeding 200 per 1,000. Six other jails record mortalities above 100 per 1,000. Among the largest jails above enumerated the highest mortality occurred in the Rajshahye Jail (109·55—but 15·45 of this was due to cholera) and the next highest in the Dacca Jail (62·20—2·44 due to cholera). The mortality in the Buxar Jail was only 2·57, and this includes 1·06 from cholera). The largest number of cases of cholera occurred in the Rajshahye, Monghyr, and Gya Jails; in each of these 17 cases were admitted. The largest actual number of deaths from all causes occurred in Alipore 97, Rungpore 59, Rajshahye 78, Mymensingh 53, Dacca 51. In Alipore, 40 of the deaths were due to bowel complaints and 20 to respiratory diseases; in Rungpore, 30 deaths were due to bowel complaints; in Rajshahye, 11 were due to cholera and 34 to bowel complaints; in Mymensingh, 33 were due to bowel complaints; and in Dacca, 21 were due to bowel complaints and 14 to respiratory diseases. In two jails, namely, Noakhally and Arrah, there were no deaths.

The health of the prisoners of the North-Western Provinces was not so good as during the previous year. The admission daily sick and total death rates (681, 26, and 20·86 per 1,000 of average strength respectively) were all in excess of those for 1883; they, however, compare favourably with the averages for 1877–81. The increased mortality as compared with that of the previous year (19·76) was entirely due to bowel complaints.

Sickness prevailed most largely in the following jails:—Etah (admissions 3,627 per 1,000), Shahjahanpur (1,831), Muzaffarnagar (1,744), Moradabad (1,752), Muttra (1,714), Banda (1,703), Saharanpur (1,582), and Orai (1,576). In the largest jails, those containing over 1,000 prisoners, the general health was good, the highest admission-rate recorded among them having been 638 per 1,000 at Bareilly Central Jail, and the lowest, only 120, at Lucknow Central Jail. Thirteen of the 52 jails in these provinces recorded admission-rates over 1,000 per 1,000 and 19 between 500 and 1,000. Only two jails recorded total mortalities over 100 per 1,000, namely, Banda (156·78) and Almora (102·80). In the large jails with over 1,000 prisoners the total mortality from all causes was very low, ranging from 16·95 in Allahabad Central Jail to 10·29 in Lucknow Central Jail. The largest actual number of deaths occurred in—Gorakhpur 39, Banda 37, and Meerut Central Jail 28. In Gorakhpur, 30 of the deaths were due to bowel complaints; in Banda, 17 to the same cause, and in Meerut, 11 to cholera and 7 to respiratory diseases. In three jails there was no mortality, viz., Gonda, Unao, and Orai.

Sickness was somewhat more prevalent among the prisoners of the Punjab jails than during the preceding year, as is shown by the increased admission-rate, from 951 per 1,000 in 1883 to 1,131; but as the daily average sick ratio (27) did not rise the type of sickness was evidently milder. This is also indicated by the somewhat diminished total mortality ratio which fell from 29·11 during the previous year to 28·04 in 1884. Bowel complaints gave rise to increased mortality as compared with the previous year, but the ratio of the year under report (7·10) is very considerably below the average mortality during 1877–81, namely, 31·64. No deaths were caused by cholera, and this is the third consecutive year in which these jails have enjoyed such an immunity. Respiratory diseases gave rise, as usual, to the largest proportion of deaths, 8·43 per 1,000 against 9·73 in 1883. This reduction is satisfactory, but the ratio still continues to be much higher than it was in former years. During 1859–67 the average mortality from these diseases was only 2·81.

Of the 36 jails in this province three showed admission-rates above 2,000 per 1,000, and 17 ratios between 1,000 and 2,000. Thus only 16 jails remained with admission-rates below 1,000. The highest admission ratios were recorded in the following jails,—Abbottabad (2,224), Dera Ismail Khan (2,005), and the Lahore Female Jail (2,125). The ratio of the last-mentioned jail alone is in excess over those of the previous year. The Abbottabad Jail contained only 76 prisoners on an average: its high admission-rate was principally due to admissions for intermittent fevers, scurvy, and bowel complaints. In the Dera Ismail Khan Jail by far the largest proportion of admissions was due to intermittent fevers, no less than 1,317 per 1,000 of the total having been due to this cause. And the same may be said of the Lahore Female Jail, where 1,776 per 1,000 of the admissions were due to fevers. Respiratory diseases were most common in the Kohat, Muzaffagarh, Montgomery, and Gurgaon Jails, in all of which the admission-rates exceeded 100 per 1,000. The highest death-rates were recorded in the Delhi (74·42), Lahore Central Jail (58·30), and Lahore District Jail (61·10). In the Delhi Jail there were 32 deaths in all, of which 11 were due to dysentery and diarrhœa and 12 to respiratory diseases. In the Lahore Central Jail, the largest in the province, the chief causes of mortality were bowel complaints, respiratory diseases, fevers, and anæmia and debility. In the district jail, the two first gave rise to the largest number of deaths: no mortality was occasioned by fevers. In four jails no mortality was recorded, and in 17 the mortality was below 20 per 1,000.

The daily average number of sick (32 per 1,000) among the prisoners of the Central Provinces was lower than usual; but the admission-rate (932) did not fall correspondingly. The chief causes of sickness were fevers, bowel complaints, and abscess and ulcers; and the chief causes of death bowel complaints, anæmia, and debility. The mortality from all causes, 42·02, shows a very satisfactory reduction upon that of the preceding two years, namely, 70·97 in 1883 and 71·05 in 1882. It is considerably below the average for these provinces, though by no means the lowest on record. The reduction has been mainly due to the diminished mortality from bowel complaints, which is extremely satisfactory. It was noted in the report for 1883 that the mortality from these diseases during that year was the highest on record since 1859, and that it exceeded the average of the preceding 20 years by 24·18 per 1,000; but the ratio of 1884 is below this average. Cholera was practically absent, only one death having occurred from it.

There are six jails in these provinces with an average population exceeding 100; three of which, Raipur, Nagpur, and Jubbulpur, have over 600 prisoners. In the Nagpur Jail, the admission-rate was 1,343, whilst in Raipur it was only 732. Fevers and respiratory diseases were much less prevalent in Raipur than in Nagpur, which mainly accounts for this difference in the admission-rates. The highest mortality was recorded in the Sambalpur Jail 70·97; of the 11 deaths which gave rise to this ratio 9 were due to dysentery and diarrhœa. In the Raipur Jail there were 35 deaths in all, 17 of these were due to dysentery and diarrhœa and 8 to anæmia and debility. In the Nagpur Jail there were 34 deaths, 15 and 5 due, respectively, to the same causes.

The vital statistics of the prisoners located in the jails of Berar were very favourable. The daily average number of sick (11 per 1,000) was remarkably low. For the third consecutive year no death from cholera took place. Compared with other jails deaths from bowel complaints were very few, whilst the total mortality (8·72) was considerably less than a third of the average for 1877–81.

There are only two jails of considerable size in this province, those at Amraoti and Akola. The admission-rates in these jails were 457 and 426 respectively; there were no deaths in any of them with the exception of the Akola Jail, in which there were nine. Bowel complaints, respiratory diseases, and phthisis caused two deaths each.

The health statistics of the prisoners in Burma show an improvement upon those of the preceding two years; but they do not compare favourably with the average results of the five-year period 1877–81. The total mortality among them (30·28) was higher than it had been during the two previous years (28·94 in 1883 and 27·81 in 1882), notwithstanding a diminished death-rate from cholera. The increased mortality over that of the previous year was mainly due to a larger number of deaths from anæmia and debility, small-pox, bowel complaints, hepatitis, dropsy, apoplexy, and respiratory diseases. The diminished admission-rate (936 against 1,159 in 1883) was mainly due to the lessened prevalence of cholera, continued fevers, bowel complaints, eye diseases, and injuries.

The highest admission-rate, 1,312, was recorded in the Rangoon Jail, the largest in the Administration. Admission-rates were also high in the Akyab, Shewgyin, and Myanaung Jails, all over 1,000 per 1,000. The last two jails are, however, very small. The largest mortality occurred in the Akyab Jail, viz., 129·19 per 1,000, but this was largely contributed to by cholera. Of the 54 deaths which took place in that jail 22 were due to this disease. In the Rangoon Jail the mortality was not great, namely, 23·52.

Sickness continued to be very prevalent among the prisoners of Assam. The admission and daily sick rates were practically the same as during the preceding year, and they were considerably above the average. Fevers and bowel complaints were the main causes of admission, together contributing 1,313 per 1,000 to the total admission-rate of 2,109. The total mortality ratio, 61·19, also rose considerably above those of the last four years. The total death-rate rose from 43·12 in 1883 to 61·19, the increase being mainly occasioned by bowel complaints, which rose from 16·58 to 24·16, by respiratory diseases, which rose from 2·49 in 1883 to 11·27 in 1884, and by fevers, which rose from 2·49 to 5·64. Cholera was very prevalent, having caused 5·64 per 1,000 of the total mortality.

There are five jails in this province, only one of which is of considerable size, viz., that at Sylhet, with an average strength of 517. The admission-rate in this jail was very high (2,288). Of the 36 admissions for cholera which were made throughout the jails of the province, 25 took place in the Sylhet Jail, all during August. Of these, however, only two died. There were 12 deaths in this jail from bowel complaints, and six from respiratory diseases.

There was a considerable amelioration in the health of the prisoners in Madras; the admission and daily sick ratios (765 and 29 per 1,000) were less than usual, and the total mortality fell very considerably. It was 20·55 against 29·87 in 1883 and an average of 63·98 during the 20 preceding years; the death-rate of the year under report is, in fact, the second lowest on record, the lowest having been 17·9 in 1871. The main cause of the reduced total mortality, as compared with many former years, has been the smaller death-rate from bowel complaints, which was only 6·18 against an average of 25·72 for the 20 years previous to 1882. But in addition to this, most of the chief causes of mortality gave rise to smaller ratios, and cholera was less prevalent than usual.

Of the 30 jails in this Presidency nine recorded admission-rates between 2,000 and 1,000 per 1,000 and eight under 500. Of the larger jails, the Rajahmundry Central Jail and the Cannanore Jail yielded the highest admission-rates, 1,329 and 1,135 respectively. In the remaining large jails these ratios varied from 395 in the Trichinopoly Central Jail to 718 in the Salem Jail. All these ratios are below those of the preceding year. Twenty-one cases of cholera in all were treated, and of these seven died: 17 of the cases with five deaths occurred in the Cuddalore Jail. Of the total number of deaths which occurred throughout the jails of the Presidency, namely, 143, 43 were due to bowel complaints, and 17 of the 30 jails recorded deaths from this cause.

The vital statistics of the prisoners of Bombay were, on the whole, favourable. The admission and daily sick ratios (702 and 26 per 1,000) were lower than those of the preceding year, but the total mortality (34·91) was fractionally greater. Excluding mortality from cholera from both years, however, the comparison is less favourable, for, whilst in 1883 cholera caused 2·05 of the mortality, during 1884 only 0·55 per 1,000 were attributable to the same cause. Still, compared with the average death-rate during the 18 years previous to 1883, namely, 47·15, that of the year under report is favourable. Bowel complaints caused a slightly higher mortality than they did during the two previous years.

Seven of the 32 jails of this Presidency recorded high admission-rates, ranging between 1,000 and 2,000 per 1,000, and eight recorded rates below 500. Most of the jails which recorded high rates were small. Among the larger jails these ratios varied from 279 in Ahmedabad to 998 in Nara. Fevers, bowel complaints, and respiratory diseases were the most frequent causes of admission. Fevers were most prevalent in the Mhasvad gang, Ahmednagar, Sawantwari, and Kaladgi Jails, whilst bowel complaints were most frequent in the Rajkot, Poona, Sholapur, and Ahmednagar Jails. The largest number of deaths, both actual and proportional, occurred in the Nara Jail. Of the 67 deaths which took place there, 29 were due to respiratory diseases, 12 to fevers, and 12 to bowel complaints. This large mortality was mainly due to the accidental burning of the jail, which left the prisoners exposed to the weather for some days. The next largest number of deaths (44) took place in the Shikarpur Jail, most of which were due to the same diseases. In five jails no deaths took place.

A very satisfactory condition of health was observed among the convicts at the Andamans. With the single exception of the admission-rate (1,465 per 1,000), which is but nominally greater than that of 1883, the results of the year under review were most favourable. The daily sick-rate was 65 per 1,000 against 67 in 1883, and the death-rate 15·75 against 19·63. The reduction in the mortality from bowel complaints, from 2·87 to 1·80, as well as in the total mortality, is remarkable and most satisfactory. As explained in the report for 1883, these results have been brought about mainly by the care which is now bestowed upon the acclimatisation of the convicts before they are put upon unhealthy works and to their greater shelter during inclement weather.

General Population.

General remarks.

In the North-Western Provinces with Oudh, Punjab, Central Provinces, and Berar, birth-rates exceeded 40 per 1,000 of the population. In Bombay the total birth-rate was 32·50, whilst in the remaining provinces it varied from 14·87 in Coorg to 29·3 in Madras. In only three provinces the death-ratio exceeded the birth-rate, namely, in Bengal (by 6·35 per 1,000), Assam (by 2·76), and Coorg (by 0·21). The excess of births over deaths was most marked in Berar, where the birth-rate exceeded the death-rate by 16·7 per 1,000, whilst the smallest excess was shown by Burma, namely, 4 per 1,000. Excluding Mysore and Coorg, in which registration is but partially and imperfectly conducted, the most uniform results in birth registration were obtained in Berar and the Central Provinces. The difference between the maximum and minimum ratios of districts in Berar amounted only to 8 per 1,000, and in Central Provinces to 13·84. In Bengal and Punjab the difference exceeded 40 per 1,000; in the North-Western Provinces it amounted to 35·66, and in the remaining provinces varied from 29·0 in Assam to 17·03 in Burma. The highest death-rate was recorded in the North-Western Provinces and Oudh, namely, 35·26 per 1,000, and the lowest in Burma, 18·95 (excluding Mysore and Coorg). The most uniform results in the registration of deaths were also obtained in Berar and the Central Provinces, the extreme variation in districts of the former province being 7·1 per 1,000, and in the latter 10·85. The greatest variation was recorded in Assam, amounting to 55·52 per 1,000. Cholera gave rise to the largest proportion of deaths to population in Assam (4·92); in Bengal and Madras it gave rise to a little over 2 per 1,000 of population. Small-pox was most prevalent in North-Western Provinces and Oudh, where it occasioned 4·59 per 1,000 of the total death-rate. Mortality from fever was greatest in the Punjab (24·71 per 1,000) and least in Madras.

During 1884 another town was added to the number of municipalities in Bengal Proper in which registration of births is carried out. The total births recorded amounted to 39,640, or at the rate of 23·51 per 1,000 against 22·08 in 1883. These ratios are manifestly much under-estimated, and when the ratios of individual towns are examined, it is evident that registration is very imperfectly performed. Of 47 towns, only two recorded a birth-rate above 40 per 1,000, seven between 30 and 40, 19 between 20 and 30, 15 between 10 and 20, and four below 10. The deaths in the province during 1884 numbered 1,378,610, or at the rate of 20·83 per 1,000 against 18·82 in 1883 and 20·41 in 1882. The ratio of 1884, like the birth-rate, is also in all probability much under the truth. The district ratios disclose still more unsatisfactory results, for of 45 districts in no less than 25 the ratios were below the provincial average. In rural circles the mortality was 20·58 per 1,000, or 0·25 less than the average for the province, but in towns the death-rate averaged 27·43 per 1,000.

In the North-Western Provinces and Oudh, the general registration of births was introduced in 1879, and in that year the recorded birth-rate equalled 28·69 per 1,000. Since then there has been considerable improvement: By a gradual increase the ratio in the year under review stood at 43·77. This improvement has been very general over the Provinces. Only three districts, Dehra Dun, Kumaon, and Allahabad, still show imperfections. In the 106 towns where registration is carried out under municipal agency, the birth-rate was 40·08. The male births of the Province show a preponderance of 10·97 per cent. over the female births. Owing to the comparative unhealthiness of the year, aggravated to a great extent by an excessive rainfall during the autumn months, the total number of deaths amounted to no less than 1,555,342, or 339,045 more than in the preceding year. This high mortality has not been equalled by that of any year since 1870, excepting the famine year 1879; and notwithstanding the high rates of births in the districts, in nine instances the death-rates exceeded the birth-rates by ratios varying from 1·10 to 15·27 per 1,000. The average death-rate of the Province was 35·26 against 27·57 in 1883. The mortality among infants less than a year old was exceedingly high, the proportion among boys having equalled 451·50 per 1,000, and among girls 407·73; and considerably more than one-half of the total deaths was among children under five years of age. The mortality in rural circles was 34·78 per 1,000, and in towns 42·47.

With a view to secure accuracy in the Punjab, the compilation of primary returns of births and deaths has since the commencement of 1884 been carried out by the Civil Surgeons of districts under the orders of the Local Government; and the results of the year bear indication of marked improvement. The births registered in the Province amounted to 809,912, or at the rate of 42·98 per 1,000, against 734,912, or 39 per 1,000 in 1883. This increase was general throughout the Province: in fact, with the exception of Simla, Peshawar, Dera Ghazi Khan, and Kohat, the district ratios elsewhere were all above 34 per 1,000, while the highest ratio in any one district was 58·59. That the average birth-rate of the Province was not much under the truth is further confirmed by the results obtained in 49 principal municipalities where the increase to population by births averaged 42 per 1,000. The low ratios of Kohat, Dera Ghazi Khan, and Peshawar are probably due to imperfect registration at those places, but that of the Simla district is no doubt affected to a great extent by the migratory nature of the population of the sanitarium. The male births everywhere preponderated over the female births, the average excess for the Province being at the rate of 14·7 per cent. Compared with the preceding four years, the year under review has been somewhat unhealthy. The total deaths of the Province numbered 660,298, or 184,557 more than in the previous year. These numbers represent ratios of 35 per 1,000 in 1884 and 25 in 1883. The increased death-rate of 1884 may in part be attributed to improved registration, but principally to the great prevalence of fevers during the autumn months. The deaths among men averaged 34 per 1,000 against 36 among women. Out of a total of 32 districts the mortality in 7 only was below 25 per 1,000, while in the others it ranged between 65 in Ludhiana and 25 in Dera Ismail Khan. The districts which yielded high rates of mortality (varying from 40 to 65) were Ludhiana, Karnal, Umballa, Delhi, Hoshiarpore, Ferozepore, and Gurdaspur; and in all of these except the last two districts the death-rates were higher than the birth-ratios. More than one-half the total deaths of the Province were among children under five years of age. The urban mortality of the Province generally as well as the death-rate of the 49 selected municipalities was 41 per 1,000, and the rural death-rate was the same as the average for the whole Province, viz., 35.

During 1884 the number of births registered in the Central Provinces was 368,036, or at the rate of 41·75 per 1,000 of population as compared with 40·59 in the preceding year. Of these 190,702 were boys and 177,384 were girls, the excess of the former over the latter being at the rate of 7·5 per cent. The births were everywhere more than the deaths, and the net increase to population, therefore, during the year was at the rate of 14·45 per 1,000. The deaths in all numbered 240,714 against 241,467 in 1881, and still higher numbers in the two intermediate years. Of these nearly one-third was among infants less than a year old and more than one-half among children under five years of age. As in the case of births, the death-rate in towns was also less than in the rural circles. The total death-rate of the Province was 27·30 per 1,000 against 34·56 in 1883. This reduction may have been due to the healthy character of the year. In all municipalities a bye-law exists to facilitate the registration of births and deaths, and the Chief Commissioner has drawn attention to the necessity of enforcing its operation strictly.

A revised system of registering vital statistics has been in force in Berar since the commencement of 1883, and has been found to work well. But sufficient accuracy has not yet been attained. During the year under review 108,725 births were registered in the Province, or at the rate of 41·3 per 1,000 of population. This number is the highest on record since 1868, with the single exception of 1882. For every 100 births of girls 107 boys were born during the year. In rural circles the births were at the rate of 41·6 per 1,000, and in towns at 38·7. Compared with 1883, the birth-rate was less in 10 of the 34 towns in the Province. In all districts the births were more numerous than deaths, the excess varying from 14·2 per 1,000 in Akola to 19·3 in Buldana, or on an average there was a net increase of 16·7 per 1,000 to the population of the Province. There were altogether 64,808 deaths during the year equivalent to 24·6 per 1,000. This ratio evidently understates the true mortality of the Province. The ratios of districts varied from 20·1 to 27·2. The male deaths exceeded the female deaths by 9·7 per cent. More than one-half the total mortality was among children under five years of age. Rural circles returned a death-rate of 24·6 per 1,000 against 27·4 in towns. These figures, however, do not admit of comparison with the statistics of the previous year, when the mortality assumed unusual proportions owing to epidemic cholera and excessive prevalence of fevers, bowel complaints, and small-pox.

In 1884 the accession to the population of British Burma by births amounted to 82,783 and the loss by deaths to 69,234. These figures yield a birth-ratio of 22·66, and a death-rate of 18·95 per 1,000 against 22·92 and 14·67 respectively in 1883. These results indicate some improvement as compared with the past year. The death-rate is the highest on record during the last 10 years. The average death-rate for the Province as a whole has been vitiated by the inclusion of rural statistics, for whilst the urban mortality, 36·65, must be near the truth, the rural mortality, 16·61, is evidently under-stated. A new system of registration, however, was introduced in some districts late in 1884 and in others from the commencement of the current year, and it is expected that the figures of 1885 will be much more accurate than those of past years. As usual, registration generally seems to have been more accurately carried out in towns than in the interior of districts. In the towns as a whole the birth-rate averaged 23·28 per 1,000 of population. This ratio cannot be accepted as strictly correct, being apparently too low. In rural circles births were recorded at the rate of 22·58 per 1,000 and deaths at 16·61.

Births were recorded in Assam of 62,941 boys and 57,542 girls, or a total of 120,483 children, equivalent to 26·61 per 1,000. This ratio, however, was made up of extremes varying from 19·38 in the Lakhimpore district to 41·65 in Goalpara and 48·38 in the town of Tura. Both the district and provincial ratios testify to considerable improvement having been made in registration during the year under review, but as in all districts except one the recorded mortality was in excess of the births, the results must still be far from accurate. Male births exceeded female births by 9·38 per cent. on an average for the Province. The loss to population by deaths amounted to 132,992, or 12,509 in excess of the registered number of births. The average death-rate of the Province was 29·37 per 1,000. As in the case of births, Lakhimpore recorded the lowest death-rate, 21·08 per 1,000, and Goalpara the highest, 49·50. More than one-third of the total mortality took place among children under five years of age. In 22 towns registration is compulsory, but the results obtained in several of them appear to be less correct than those recorded in districts where registration is voluntary. Registration in tea-gardens shows a considerable improvement on the results of the preceding year, as in them the birth-rate was 31·66 per 1,000 and the death-rate 40·91. This death-ratio is high, but in connexion with it the fact must be borne in mind that the coolies in these gardens are all imported and subjected to climatic conditions differing often considerably from those to which they have been accustomed.

The results of registration in Madras Presidency during 1884 bear indications of greater accuracy in the recording of vital statistics than in any of the preceding years since 1869. But better as they are, there is still much room for improvement. The births numbered 827,381, or at the rate of 29·3 per 1,000 against 27·7 in 1883, which again was the highest ratio recorded in any year since the commencement of birth registration in this Presidency. Of the total births 15 per 1,000 were boys and 14·3 girls. The births in all the districts were in excess of the deaths except in Godavari, Tanjore, and Tinnevelly. The loss to population by deaths during the year amounted to 650,335, or at the rate of 23·1 per 1,000 against only 19·0 in the previous year. This increase may have been partially due to improved registration, but there is no doubt that it was mainly owing to the great prevalence of epidemic cholera, small-pox

fevers, and bowel complaints. That little progress has yet been made in the registration of deaths is apparent from the very great variation in the death-rates of districts, where they ranged between 14·5 in Ganjam and Nellore to 35·7 in Tanjore. In the city of Madras deaths were recorded at the rate of 49·4 per 1,000. In the rural circles the death-rate was 22·7, or 0·4 less than the average for the Presidency; but in towns the average mortality of the year was 27·7 per 1,000.

In the Bombay Presidency the births of the year amounted to 534,723 against 501,891 in 1883 and a mean of 368,558 for the 10 years 1874–83. The average birth-rate of the Presidency during the year under review was 32·50 per 1,000, which is higher than that of any year since 1874. It is made up, however, of extremes, varying from 16·91 in Hyderabad to 43·43 in Dharwar. The statistics of the city of Bombay and the Sind districts still show great imperfections. The excess of boys over girls born during the year was 9·09 per cent., and the average excess of births over deaths 7·68 per 1,000. The deaths recorded during the year numbered 408,409, or at the rate of 24·82 per 1,000 against 420,198 and 25·53 in 1883. The maximum mortality occurred in November and the minimum in June. In rural circles the death-rate was at 24·17 and in towns at 29·25 per 1,000. Cholera was less prevalent than in the preceding year, but the deaths from small-pox, fevers, and bowel complaints were more numerous than in 1883.

The results of the registration of births and deaths in Coorg in 1884 are far from encouraging. A birth-rate of 14·87 per 1,000 and a death-rate of 15·08 are manifestly incorrect. In all 2,652 births were recorded, Of these 1,349 were boys and 1,303 girls. The deaths numbered 2,689, the majority of which was due to fevers. Not a single death is stated to have been caused by cholera during the year.

History of Chief Diseases.

Cholera.

The total number of deaths caused by cholera throughout those parts of the Indian dominions in which registration is effected exceeded that of the previous year, the numbers being 287,609 in 1884 and 248,860 in 1883. The largest aggregate number of deaths in any one Province was recorded in Bengal, but the highest proportion of deaths to population occurred in Assam, where this ratio was 4·92 per 1,000. Of the 14 provinces enumerated in the following table only four recorded fewer deaths than during 1883, namely, the Central Provinces, Berar, Central India, and Bombay:—

Annual Deaths from Cholera in India, 1874 to 1884.

Province.	Population.	Deaths from Cholera.										
		1874.	1875.	1876.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.
Bengal* - -	—	56,876	109,988	196,590	155,305	95,192	136,363	39,643	79,180	182,352	90,439	134,421
Assam - -	4,527,934	16,478	6,618	8,615	11,377	6,782	17,415	2,803	5,010	21,055	14,908	22,276
North-Western Provinces and Oudh - -	44,107,869	6,464	64,427	48,311	31,770	22,221	35,892	71,546	25,865	89,372	18,160	30,143
Punjab - -	18,849,264	78	6,246	5,736	29	215	26,135	274	5,207	39	190	514
Central Provinces	8,847,185	14	14,643	20,124	3,418	40,935	27,575	330	9,140	11,932	16,235	149
Berar - -	2,650,018	2	22,465	2,683	842	34,306	223	1	3,404	3,573	27,897	37
Rajputana - -	‡	†	1,203	283	60	2,393	318	—	197	1,327	797	1,297
Central India -	‡	†	2,555	1,929	926	8,047	2,734	299	581	1,562	1,740	1,018
Bombay - -	16,464,414	37	47,573	32,117	57,228	46,743	6,937	684	16,694	7,904	87,954	18,804
Hyderabad -	‡	†	10,891	5,582	7,414	6,696	6	—	1,721	150	1,947	2,479
Madras - -	28,151,952	313	94,547	148,189	357,430	47,167	18,296	613	9,446	23,604	36,284	75,476
Mysore - -	4,186,188	†	2,505	12,087	2,902	728	14	25	25	893	124	330
Coorg - -	178,302	†	†	210	†	49	—	—	3	31	—	—
British Burma -	3,653,629	960	761	3,678	7,276	6,759	1,828	2,638	5,239	7,177	2,185	5,515

* Excluding Calcutta. † Statistics not available. ‡ Population not known.

In the Central Provinces and Berar the reduction over the numbers of the preceding year was very marked, but these provinces are especially liable to invasions by the disease in remarkable epidemics of intense severity followed by periods of considerable quiescence. The main burden of the excess in the aggregate number of deaths from this cause throughout India over that of the preceding year was borne by Bengal proper and Madras.

In Bengal Proper the largest number of deaths occurred as usual early in the year, the maximum number having been recorded in April. In Assam the maximum was reached in May, and in the North-Western Provinces not until August. In the Madras

Presidency the disease caused the largest mortality as usual during the cold months, whilst in the Bombay Presidency the period of greatest mortality coincided most closely with that of the North-Western Provinces, namely, July and August.

In Bengal the disease was widely prevalent after a year of comparative abeyance. In this Province 134,421 persons died of the disease, a number exceeding that of the previous year by 43,982, and yielding a mortality of 2·03 per 1,000 against 1·36 during 1883 and 1·59, the average of the previous five years. The disease prevailed with special severity in Orissa, where 4·95 per 1,000 of population fell victims to it against an average ratio of 2·97 during the preceding five years. In Bengal Proper also, the incidence of the disease was severe, causing a mortality of 2·71 per 1,000 against 1·51 during the previous five years. In Behar and Chota Nagpur it was less prevalent, giving rise to mortalities of 0·76 and 0·79 per 1,000 respectively. Throughout the Province 10·8 per cent. of villages were affected, varying from 24·29 per cent. in the Presidency division to 2·24 per cent. in Chota Nagpur. As regards the seasonal prevalence of the disease, the months of greatest prevalence for the province, as a whole, were April and May and November and December. The season of maximum intensity varied, however, in different parts. In Bengal Proper March to May and October to December were the months of greatest mortality, whilst in the remaining parts, Behar, Orissa, and Chota Nagpur, May to August were on the whole the worst months. Urban mortality throughout the Province was 3·81 and rural 1·96 per 1,000.

Cholera was unusually prevalent in Assam; indeed the mortality from this cause throughout the Province, 4·92 per 1,000 of population, is the highest on record. The disease prevailed severely in every district, but was most severe in Nowgong, where deaths were in the ratio of 8·95 per 1,000. In the Darrang and Sibsagar districts the mortality exceeded 6 per 1,000. For the Province as a whole deaths from cholera began to increase in March and gradually but quickly reached a maximum in May. Thereafter the numbers declined until in September they were fewer than they had been in March; but in October the disease was rekindled and gave rise to many deaths. In regard to the seasonal prevalence of the disease some differences are observable in its progress through the Brahmaputra and Surma valleys. In the Surma valley the disease showed signs of activity earlier, the number of deaths due to it beginning to rise in February, and its autumnal resuscitation was both earlier and more intense, commencing in September and attaining a severity in November, exceeding the maximum intensity of the earlier epidemic period which was attained in May. In the Brahmaputra valley deaths from this cause did not begin to rise appreciably until March, and the highest number was recorded in June, whilst the autumnal recrudescence was but little marked. In this Province the urban and rural death-rates from cholera did not differ much: in towns the death-rate was 4·49 and in rural circles 4·93. Throughout the Province 21·9 per cent. of villages were attacked.

The history of cholera among immigrant coolies to Assam during 1884 presents several features of interest, for although the disease prevailed with unusual severity in the districts of the Brahmaputra valley, these coolies escaped to a remarkable extent. Whilst mortality from cholera in the districts of the Brahmaputra valley as a whole equalled 5·8 per 1,000 of population, that amongst immigrant coolies was 1·4 per 1,000, and much of even this mortality may have been due, as will be shown below, to unfavourable influences acting upon them before they entered the province of Assam. The table in the margin exhibits the deaths from all causes since 1877, and shows that the death-rate among the coolies during 1884 was amongst the most favourable on record. The mortality ratios of 1880 and 1881 are certainly lower than the ratio of 1884, but when the large increase in the number of immigrants during 1884 and the progressive improvement in registration are taken into consideration, the result of 1884 may fairly be regarded, in the words of the Sanitary Commissioner of Assam "as the best record "of successful sanitation." During 1884, 26,270 immigrants entered Assam against 16,983 in 1883 and 10,454 and 11,250 during 1880 and 1881. Among the large number of immigrants during 1884, 68 deaths from all causes took place on the river, of which 37 were due to cholera. It is interesting, however, to observe that no less than 32 of these deaths occurred "when the coolies were sent "hurriedly away from the depôts in consequence of epidemic cholera at Dhubri," their starting point in Assam. The whole number of deaths from cholera was distributed in time as follows:—2 in January, 18 in February, 8 in March, 6 in April, 2 in May, and

Year.	Number of deaths on the river.	Ratio per mille.
1877	904	29·9
1878	794	33·8
1879	106	8·2
1880	23	2·2
1881	18	1·6
1882	106	6·5
1883	138	6·6
1884	68	2·6

1 in November. Comparing this seasonal distribution of deaths among coolies with the mortality from cholera by months among the inhabitants of the districts bordering the Brahmaputra river, it appears that the great majority of deaths among coolies occurred before the disease became epidemic in the bordering districts. The districts through which the coolies pass on their upward journey from Dhubri to Dibrugarh are in succession Goalpara, Kamrup, Darrang, Nowgong, Sibsagar, and Lakhimpur, but the last-named district has little connection with the river. In Goalpara the disease did not become epidemic until May, and prevailed with maximum intensity during June and July. In Kamrup it began to increase in April, and was most prevalent during May, June, and July. In Darrang it prevailed epidemically from April to June, and in Nowgong from June to August, with some diminution in September and renewed activity in October and November. In Sibsagar the months of greatest prevalence were March to June. Thus, during February and March, when 26 of the whole 37 deaths occurred among coolies, cholera did not prevail with epidemic intensity in most of the districts through which they passed; and 34 deaths preceded the month of maximum intensity of the disease in any district. The occurrence of one death from cholera of a cooly in November is interesting, as during this month a recrudescence of the disease occurred in the Nowgong district as has already been noted, and cholera prevailed intensely. Turning next to the history of the disease at Dhubri, the most striking fact is that cholera prevailed there most severely, considerably before the district as a whole was invaded epidemically. The Medical Officer at Dhubri reports that cholera prevailed epidemically in the cooly depôts during February, March, and April, but of the 137 men attacked, 24 arrived with the disease, 30 were admitted into hospital for it within 24 hours, and 33 within 48 hours of arrival. Thus a large number of deaths occurred within 48 hours of their arrival. Moreover, it is stated that about 15 deaths occurred among coolies on board the railway steamers before they could reach the depôts, and which are therefore not included in the 137 total cases above referred to. But although cholera was not epidemic in the Goalpara district in which Dhubri is situated during those months, it was springing into activity in the Burdwan district of Bengal through which these coolies passed, and where they probably rested, as cooly depôts are established in it. Cholera deaths in that district were registered as follows:—January, 46, February, 28, March, 323, April, 1,003, May, 421.

The late Sanitary Commissioner with the Government of India, in considering the history of outbreaks of cholera among these coolies, was of opinion that on the whole coolies suffered in common with the people through whom they passed, as the conditions favorable to the development of the disease were common to all. He pointed out that such a view did not necessarily imply liability on the part of the coolies to attack contemporaneously with the maximum prevalence of the disease among the inhabitants of the country through which they passed, and in support of his argument he adduced the well-known fact that certain villages of an epidemically affected area suffered severely sometimes at a time when the maximum intensity of the disease for the area as a whole had either passed by, or had not as yet been attained, whilst others escaped affection altogether; in other words, that the history of localised outbreaks of cholera showed that affected areas are by no means uniformly attacked either in space or time. Whilst a given community of coolies are travelling through an affected district, be it by land or water, they may be regarded as a village of the district, and as such liable to attack or immunity in common with other communities of the district, and all that can be done in the present state of our knowledge to avert the attack either of a fixed or a moving community is to improve its sanitary condition and make it as perfect as possible. With improved sanitation in all its aspects, whether accomplished in a village or on board a steamer, we have every reason to look for a lessened liability to sickness, and this is true not only of cholera, but of disease generally. During the year under report the communities of coolies passing up the Brahmaputra river may be regarded in the same light as the more fortunate villages of the districts through which they passed, which escaped attack altogether or which suffered but little. It is not to be denied, however, that the history of the disease admits of a different interpretation. It may be argued that there is much in the history of the year under report to show that the disease was contracted before they entered Assam, and that it was consequently imported by them. It is difficult to determine which of these views may be the correct one, but fortunately from a practical sanitary point of view it is immaterial which view is accepted, for experience shows clearly that the only means in our power to diminish liability to attack of communities is a scrupulous attention to general sanitation. Much has been done of late years to improve the

sanitary condition of the surroundings of the coolies, and in consequence there has been diminished prevalence of sickness and lessened mortality. Before closing this paragraph it is desirable to call attention again to the effect the introduction of a faster steamer service may exert upon the liability to attack of the coolies whilst passing through affected areas. It is evident that the more quickly bodies of men are passed through affected areas, the less liable they will be to contract the disease, whether we believe the disease is caused by a variety of unfavourable influences surrounding the locality or to a particulate entity. Moreover, with an improved system of transport not only are the consequences of prolonged subjection to unfavourable influences surrounding affected areas considerably lessened, but many of the evils generally attendant on the close aggregation of large bodies of men are removed. Whilst formerly slowly moving ships carried from 500 to 600 coolies on board, the steamers of the fast service introduced towards the end of 1883 carry only 175 souls on board. During 1877–78 nearly 70 per cent. of immigrant coolies embarked at Goalundo, and the journey from that port to their destination, Dibrugarh, occupied 16 days. During 1883 only 18·87 per cent. of coolies embarked at Goalundo, the remainder embarking at Dhubri, and the voyage for the greater number lasted about 12 days. During 1884, 90 per cent. embarked at Dhubri, and the voyage was shortened to an average of 4 days and 20 hours. The beneficial effect of this acceleration in transport cannot be over-estimated. The evidence afforded by the history of cholera among these coolies has often been adduced in support of the most various and contradictory views of the causation of the disease. It is evident, however, from the history just given that sanitary measures to improve the surroundings of coolies during their progress up the river have followed one another so rapidly that the effect of the introduction of any one of them on the causation of this still mysterious disease cannot be distinctly traced. Of the various explanations, however, which have been offered to account for the diminished prevalence of cholera among them of late years, that given by Dr. De Renzy, the late Sanitary Commissioner of Assam, that an improved water supply is the chief cause, cannot be accepted, for Dr. Eteson, the present Sanitary Commissioner, writes:—"The coolies who alone are provided with protected and filtered water alone get cholera; other passengers who always draw water over the side and at landing places where the steamer stops and pollution is most probable never get it. The crews of all the steamers use unprotected "water, and are never attacked." In conclusion, it may be stated that Dr. Eteson believes that the production of cholera among these coolies can be attributed to no single cause, but to a variety of concurrent insanitary conditions, and he attributes the immunity experienced by them during 1884 to the following causes:—

(1) To the avoidance of over-crowding; the mail steamers carrying small batches of 175 souls instead of several hundreds as formerly.
(2) To the speed of transport, not because they are carried quickly through affected areas, but because the speed ensures thorough perflation and ventilation.
(3) To the greater attention paid to the medical inspection of coolies at Dhubri, resulting in the provision of better food, clothing, medicines, water, bedding, medical comforts, &c.
(4) To the improved general sanitary arrangements on board, more especially with regard to cook-houses, latrines, general and hospital accommodation.

Though more prevalent than during the preceding year, cholera was not unusually prevalent in the North-Western Provinces, as compared with a series of past years. The disease gave rise to 30,143 deaths, or 0·68 per 1,000 against 18,160 or 0·41 during 1883. The mean ratio of mortality during the previous five years was 1·09. It should be noted that the year 1883 was remarkable for the quiescence of the disease. It appeared in an epidemic form only in the Trans-Jumna districts, Hamirpur, Banda, Jalaun, and Jhansi. The two last-mentioned districts had not suffered epidemically from the disease since 1870, the year in which the registration of cholera deaths was commenced in them. But although the disease in an epidemic form was confined to these four districts, it was nevertheless very widely prevalent to a lesser degree; for of the 49 districts in the Provinces, all but two returned some deaths from this cause. Again, 57 per cent. of registration circles reported deaths and 3 per cent. of all villages. The months of greatest prevalence were May, June, August, and September. It was again observable that the movement of the disease was in general from the south-east to the north-west. In the four most largely affected districts the death-ratios were—Hamirpur 6·13, Banda 2·32, Jalaun 4·92, and Jhansi 5·62. The mortality in towns equalled 1·73 per 1,000, whilst in rural circles it was 0·61.

In the Punjab cholera caused 614 deaths, or 0·03 per 1,000, against 190 or 0·01 in 1883. The death-rate for 1884 was still considerably below the average, for the mean

ratio of the preceding five years, including periods of remarkable quiescence of the disease, was 0·36. Moreover, the disease was very confined in its area of incidence, for of the total number of deaths no less than 526 occurred in one district, Kangra. Unfortunately the history of the disease in this district was not available, but most of the deaths were reported to have occurred in May, June, and August.

The disease in the Central Provinces was less prevalent not only as compared with the past year, but also with the nine preceding ones. It gave rise to 149 deaths only against 16,235 in 1883, or a ratio of 0·02 against 1·84 in 1883 and 1·64, the mean of the preceding five years. Of the total number of deaths recorded in 1884, 84 occurred in Nimar, 29 in Chanda, and the rest in small numbers over six other districts. The disease appears to have commenced in the western districts, the first reported case having occurred on the 6th March in the Nimar district. On the 14th of the same month it appeared in the Narsinghpur district, passing over the intervening district, Hoshangabad, in which the disease did not appear until July. During August the Provinces were entirely free of the disease, but in September the Jubbulpore and Chanda districts became affected, and this initiated a second outbreak which happily subsided during December, when only one death was reported throughout the Province. Of 27,674 villages in the Province only 40 were affected, or 0·14 per cent. The ratio of mortality in the district and in towns was identical, namely, 0·02 per 1,000.

In the Hyderabad Assigned Districts, cholera was remarkably little prevalent. It gave rise to 87 deaths in all, a ratio of 0·03 against 27,897 or 10·6 in 1883. Of the 87 deaths 51 occurred in Buldana, 30 in Akola, and 6 in Ellichpur; the remaining three districts of the Province enjoyed a complete immunity from the disease. In Buldana the disease appeared in two distinct outbreaks separated by a comparatively long interval. The first, which was a slight one, occurred in May, and died out after causing five deaths; the second began in September. In Akola all the deaths recorded took place in November. In both these districts the Civil Surgeon inspected the affected places at the time, and in each instance the origin of the disease was attributed to local causes, no connection having been established between affected localities and other known affected sources. Of 113 circles of registration in the Province 10 only were affected, and only 19 villages out of a total of 5,501. The disease was therefore remarkably confined in the area over which it prevailed. The total number of persons attacked is stated to have been 209, so that the percentage of deaths to seizures was 41·6—a comparatively low proportion.

Cholera gave rise in British Burma to a larger number of deaths than in 1883 by 3,330, the total numbers for each year being 2,185 in 1883 and 5,515 in 1884. The deaths during 1884 represent a mortality of 1·51 per 1,000, the mean average of the preceding five years being 1·08. Whilst in 1883 cholera was most prevalent during the first half of the year, during 1884 its ravages were greatest in the latter half. Again, almost all the districts which suffered least in 1883 had a larger number of deaths in 1884. But although the disease was very prevalent, it was confined in the area over which it occurred, for of 843 circles only 137 were affected, and only 1·5 per cent. of the villages of the Province were affected. The Arakan division suffered most in proportion to population, the mortality ratio per 1,000 of population being 2·11; but the largest aggregate number of deaths were recorded in the more populous Irrawaddy division. The disease caused proportionately twice as many deaths in towns as in rural circles, the ratios being 2·68 and 1·36 respectively. Of towns, Pantanaw (with a mortality ratio of 8·58 per 1,000), Henzada (7·65), Yandoon (7·18), and Prome (7·08) suffered most.

Cholera in the Madras Presidency caused twice as many deaths as it did during the previous year, namely, 75,476 deaths equal to 2·7 per 1,000 of population, against 0·5, the last quinquennial mean. The disease was therefore unusually prevalent. South Canara was the only district which escaped with complete freedom, but several districts suffered slightly. It was especially prevalent in the districts towards the south-east of the Presidency; Tanjore (11·1), Tinnevelly (9·6), and South Arcot (4·4) suffering most severely; the districts of Trichinopoly (3·7) and Madura (3·5) coming next in order. Throughout the Presidency 13·8 per cent. of villages were attacked, but in the above-mentioned districts the per-centages were as follows:—Tanjore 55·6, Tinnevelly 56·7, Trichinopoly 40·7, South Arcot 33·4, Madura 9·2. The disease caused the largest number of deaths in January, and thereafter the numbers rapidly subsided until the minimum was registered in April. Deaths then began to rise again in number until July, when a second subsidence occurred lasting until October. Thereafter a final recrudescence occurred, and during December the

number of deaths became again almost as numerous as they had been in January. As usual, mortality in towns was greater than in districts, the ratios being 5·3 and 2·5 respectively. Regarding the prevalence of cholera in the Tanjore district, it is stated in the Annual Report of the Sanitary Commissioner for Madras that—"The conditions "of soil and water in Tanjore are very similar to those in Lower Bengal, where cholera "is endemic though the climatic conditions of Bengal and Tanjore vary considerably. "Experience shows that in every new epidemic of cholera the disease will linger longer "in Tanjore than anywhere else. . . . . I believe that the habits of the people "and their mode of life in the delta portions of the district largely contribute to the "up-keep of cholera in their midst. They live in the midst of irrigated lands, and "when the rivers have dried up, take very little care of the drinking water supplies. "While the district is a wealthy one regarding its agricultural produce, the actual "labourers are very poor and live in wretched hovels built on a damp porous soil. "The cause of the continued prevalence of cholera in the Tanjore district was most "probably owing to the peculiarly contaminated water-supply upon which the people "are dependent. And the peculiarity of the water-supply and the habits of the people "favour in every possible way the propagation and retention of the disease. The beds "of these water-courses in the dry weather are used as *places d'aisances;* but when "they contain water, the banks are used, and the individual proceeds at once to wash "his person in the water. These water-courses feed the tanks, and on these tanks the "people in almost all the towns and villages of Tanjore depend for their drinking "water."

Cholera in Bombay Presidency was considerably less prevalent than in 1883. It gave rise to 13,804 deaths, or 24,150 less than in 1880, and 11,585 less than the mean of the preceding 10 years. It prevailed epidemically in two separate portions of the Presidency: (*a*) along the coast districts from the Gulf of Cambay to the southern districts adjoining the Madras Presidency, extending there in area and involving all the districts of the southern registration circle, namely, Belgaum, Dharwar, Kaladgi, and Kanara; (*b*) along the Indus valley. These two epidemic areas are separated by Kutch. The total mortality of the year throughout the Presidency represents 0·84 per 1,000 of population, the mean of the previous 10 years being 1·56. In only nine previous years since 1866 has the mortality been lower than during the year under report. The disease prevailed most severely in the districts of the southern registration circle already mentioned, but especially in Dharwar, where 4,655 of the total number of deaths were recorded, equal to 5·27 per 1,000 of population. In this district 33 per cent. of villages were affected, but throughout the Presidency only 5·78 per cent. of villages suffered. After enjoying an almost entire immunity since 1879, Sind was again visited by the disease, only two of its districts, namely, Thar and Parker, escaping without any deaths. Throughout the Presidency the mortality among those attacked was 52·93, but this ratio ranged from 36·5 in Kaira (Gujarat) to 79·3 in Hyderabad (Sind). In Dharwar, where the disease was severest in incidence, the ratio was 51·2.

In connection with the occurrence of cholera on board ships at sea, an outbreak of the disease among coolie emigrants from Calcutta to St. Lucia presents some features of interest. Among the coolies collected together at the Calcutta coolie emigrant depôt previous to embarkation on board the steamship *Bracadale*, one child was seized with cholera and died on the 29th May. In consequence of this the embarkation of the coolies was delayed four days. No other cases having occurred, and no indications existing of any further threatened attack, the ship sailed on the 4th June with 650 souls on board for St. Lucia, including the parents and relatives of the child who had died of cholera. The steamer is described as a fine vessel, very clean, and with excellent accommodation. She experienced rough weather in the Bay of Bengal, where even the water closets could not be cleaned, and arrived at Colombo on the 11th, and on that day a child who had been suffering from diarrhœa since the 8th, died. The case was not at the time recognised or recorded as one of cholera. On the following day, the 12th, another child died while the ship was still in harbour. This case also was not entered on the Register as one of cholera, and the vessel sailed that day for the Cape of Good Hope. On the 13th, another child died after a few hours of illness, and from that date till the 10th July, when the epidemic ceased, there were amongst the emigrants 23 cases and 19 deaths. The first adult coolie was attacked on the 21st. There were thus in all 25 cases among the emigrants as follows:—

7	cases and	6	deaths	among male adults.
4	„	4	„	female „
14	„	11	„	children.

Of these 14 children, one was four days old, two were 18 months, five were three years of age, two were four years, one was six, one was seven, one was eight, and one was ten. The earliest cases were first entered as diarrhœa, and the name subsequently changed after the disease had become distinctly unmistakeable. But assuming that they were all undoubtedly cases of cholera, the first case began with ordinary diarrhœa three days after the vessel left Calcutta, or 10 days after the death of the child from cholera at the depôt, and did not end fatally until the seventh day after sailing, or the 13th day after the death of the child at Calcutta. In the 18th Annual Report of the Sanitary Commissioner with the Government of India, no less than eight cases are recorded in which cholera broke out on board emigrant ships after being more than 20 days at sea. The ship arrived at St. Lucia in the first week of August, and the passengers and crew were immediately put in quarantine, and whilst thus segregated many deaths occurred among them from other diseases, showing, in the words of the Protector of Immigrants there, that "this was a wretched sickly lot, steeped in the "disease of vice with all its baleful consequences."

In conformity with the practice followed in previous years, extracts are given in the following paragraphs from the reports of Medical Officers on the circumstances attending outbreaks of cholera which came under their observation.

Amongst British troops in six instances a history of indiscretion in eating or drinking is given as attending the first cases. In one of these cases it is stated that the patient in the evening, previous to attack, "gorged himself in the coffee shop, having eaten largely "of curry and rice, which he washed down with copious draughts of tea and followed "up with a number of buns. He had not been subjected to any fatigue nor exposed "to the weather. A case of cholera occurred in the town on the 13th April, or six "days previously, in a part which this soldier is not likely to have gone to." In three instances the first persons attacked were in hospital under treatment for other complaints, or had been but recently discharged from hospital. In one case which occurred in Calcutta the patient was a recruit, who had been a tea planter, but who for several weeks previous to enlistment had been living in Calcutta under great hardships and privations. In six instances a previous history of physical fatigue is given, but in most cases this was not by any means of an excessive kind. Among Native troops nothing of consequence in this respect is related. Soldiers are of course often on duty involving a certain amount of fatigue prior to attack, and accordingly we have several such instances recorded, but no particular hardship or exposure is instanced. Among the prisoners of India, in 23 of 28 jails affected, no unusual antecedent fatigue was noted. One prisoner was attacked while recovering from dysentery, and three a few days after discharge from hospital, where they had been treated for other diseases. At the Meerut Central Jail, where 28 cases occurred in all, it is stated that the first man attacked was of poor physique and very subject to fever. He had been working at a brick-kiln, and the second case occurred also in the person of a man similarly employed.

In the great majority of cases diarrhœa was not prevalent either among British or Native troops during outbreaks. Of 26 communities of British troops attacked by the disease, in 21 diarrhœa was stated not to have been prevalent. In one case only it was noted to have existed to a considerable extent. Among Native troops only five of 21 communities were affected with diarrhœa to some extent. On the other hand, among prisoners diarrhœa was usually prevalent at the time of outbreaks. At Meerut the Medical Officer reports that "there was no special prevalence of diarrhœa before "the outbreak, but during its progress, especially towards the close, it became very "common, severe, and alarming in connexion chiefly with fever or running into "dysentery." At Akyab, where 30 cases occurred, diarrhœa was very prevalent.

As regards British troops, complete information regarding the number of buildings occupied by affected communities and the number of these furnishing cases is not given, but accurate information is afforded in the case of 317 buildings occupied by such communities, and of these 51 furnished cases, equivalent to 16 per cent. This is a smaller ratio than that of the previous year, which was 21 per cent. In the Native Army the number of buildings occupied by affected communities was 2,228, of which only 39, or 1·7 per cent., furnished cases, against 2·3 per cent. in 1883. Among jails, of 473 buildings thus occupied, 67, or 14 per cent., furnished cases, against 18·2 per cent. in 1883.

No special atmospheric condition is associated with the appearance of cholera. The weather is described variously as hot, sultry, still, cloudy, &c., or again as wet and damp. At Allahabad, in connexion with an outbreak in September in the J.-2 Royal Artillery and Det. D. L. I., it is noted that a few days before the outbreak very heavy

rain fell, nearly four inches in 24 hours—a most exceptionally heavy fall and quite unlooked for. Medical Officers in charge of Native troops report stormy weather with thunder and lightning in three cases, rain in three, and damp and cloudy weather in three.

Accurate data are available regarding the number of attendants who came in contact with 182 cases of cholera in the British Army during the time they were being treated, namely, 364, and of these two contracted the disease, equivalent to 0·55 per cent. Of the two attacked, one, a medical officer, was one of six attendants on two cases at Fattehgarh, and the other was one of six attendants on three cases at Khandwa. No special reasons are given in the first case for supposing that the attack was due to contact with the patients. In the second case, the wife of a patient, the medical officer writes that she "contracted the disease from her most devoted attentions to her "husband." It should be noted that at Meerut and in the 2nd North Staffordshire Regiment marching from Quetta to Karachi, where the largest number of cases, occurred, not a single attendant was seized with the disease. At Meerut 39 people attended upon 56 cases, and in the marching regiment 30 attended upon 48 patients. Among Native troops 277 persons attended upon 66 cases, and not one contracted the disease. The largest proportion of attacks amongst those attending upon sick persons is recorded in the jail population. The conditions of jail life involving the aggregation of as many persons as possible within a small area, and exposing them all to like influences, would lead us to expect such a result. In jails 163 cases occurred and 252 attended upon them. Of these, seven got the disease, equivalent to 2·78 per cent. of their numbers. One victim was one of five attendants on 17 cases at Rajshahye, another one of 16 on four patients at Bogra, and with reference to this the Medical Officer writes—"I do not believe that he got the contagion, but I attribute his illness to the fact "of his taking a large quantity of food." At Cuttack one attendant of 12 on four patients got the disease: he was a sweeper employed in the garden who assisted in carrying and burying the excreta of the first case and was attacked five days afterwards and died. At the Meerut Central Jail two attendants of 13 were attacked, and at Akyab one of five; but no explanation is offered of these seizures. These results are brought together in the marginal table. It will be observed, that taking them altogether only 1·00 per cent. of attendants was attacked.

—	Number of Cases of Cholera treated.	Number of Medical Officers, Attendants, &c.	Number of these attacked with Cholera.	Percentages of Attendants attacked.
European troops	182	364	2	0·55
Native troops	66	277	0	0·00
Jails	163	252	7	2·78
Total	411	893	9	1·00

In most cases no sanitary defects of any consequence could be detected as possible sources of the disease among British troops. At Dinapore it is stated that "for some "time before the outbreak there was a considerable quantity of fruit for sale in the bazars, "and it is supposed the men partook of that freely." At Gwalior the "foul condition "of the tanks within the fortress" is again complained of, and it is further noted that "at certain seasons of the year soakage into the wells for drinking water after "heavy rain and faulty system of conservancy and sanitary condition of the surrounding "cities of Gwalior and Lushkar" are notable defects. With reference to the outbreak of cholera in the 2nd North Staffordshire Regiment marching from Quetta to Karachi, the Medical Officer reports that "all the camping grounds in the Bolan Pass were in "an unsanitary condition, a quantity of refuse matter being scattered about." Among jails in most cases no sanitary defects could be found. At Arrah the water of two large jail wells was found to contain an excess of chlorine and inorganic solids. At the Meerut Central Jail "the surrounding ground is low-lying and outfall small. It is "therefore not easily drained; the parade grounds in cantonments had been well "manured for grass growing; and as the jail lies low, most of the drainage from it "must pass by way of the jail.

The effect of movement of affected bodies into other though near localities was as usual most beneficial. Among British troops, cholera appeared in 26 communities, and in 15 of these movements were made into camp, in three to different barracks, and in eight the disease occurred in an isolated form and no movement was considered necessary. In 10 of the 15 movements into camp no further case occurred after movement. At Allahabad, where 19 cases occurred in all, only one man was attacked after the affected community moved into camp. Only at Meerut was the result of movement not so strikingly apparent. In this station the affected men were broken up into five parties which each moved into separate camps. In one party nine cases occurred in three different camps, and in another four cases in two camps, but the three remaining parties escaped without further attack. Amongst Native troops nine

of 21 affected communities moved into camp, and in only one of them a single case occurred after movement. Among prisoners movements were made only at Meerut and at Akyab. In the former place only two cases occurred after movement, although this was attended by much discomfort owing to heavy rain. The history of the epidemic at Akyab is especially interesting in this respect as well as in others: the Medical Officer writes:—"On the appearance of the first cases of cholera in the jail "it became a question whether it would be advantageous to the prisoners to take "them from the jail, wherein they had for two months been secure from cholera "(notwithstanding the prevalence of the disease in the town), and locate them outside "the jail in an area which had been affected with the disease for that space of time; "to move them beyond the affected area was impracticable. And this question with "a rider suggesting that barracks should be constructed, but not occupied unless the "disease increased, was submitted to the Inspector General of Prisons, who replied "that no delay whatever should take place in the matter of removal, but that two-"thirds of the prison population should as soon as possible be moved into camp. The "result justified the expediency of this decision, for no sooner had the removal been "commenced and the jail population thereby thinned, than the disease began to abate "and speedily became altogether arrested; while of the prisoners who were camped "out not one was attacked. . . . On the expiration of 10 consecutive days "without the appearance of any fresh case of the disease, the return to the jail of the "prisoners camped out commenced, and by the 5th of November the entire convict "population was again within the jail walls."

Small-pox was generally very prevalent throughout India. It gave rise to 332,904 deaths, against 232,363 in 1883, a year itself of unusual prevalence of the disease. The largest number of deaths took place in the North-Western Provinces and Oudh, where no less than 202,541 of the total number of deaths were recorded, yielding a ratio of 4·59 per 1,000 of population. Such a mortality in these Provinces has not been recorded in any year since 1870. Its severity was mainly confined to the districts of Oudh. Of the total number of registration circles, 82 per cent. returned deaths from this cause and 40 per cent. of villages. Whilst the district mortality equalled 4·75 per 1,000, town mortality was only 2·18. The Madras Presidency suffered the next most severely from this disease. It recorded 61,247 deaths, or 23,272 in excess of the total number of 1883; or in other words, the mortality of 1884 was 2·1 per 1,000 against 1·3 during the previous year. Both ratios are unusually high, as the mean ratio of the previous five years (including 1883) was 0·7. The disease was very widely diffused over the Presidency, as no less than 226 circles of registration out of 229 recorded deaths. Rural and urban ratios were remarkably alike, the former being 2·1, the latter 2·3 per 1,000. The Province of Bengal recorded the next highest aggregate number of deaths, though it does not stand next in proportionate mortality to population. In all, 18,533 deaths were caused by this disease against 9,714 in 1883, or 0·28 per 1,000 of population, against 0·14 in 1883. Deaths were recorded in 53 circles, or in 2·96 per cent. of villages against 1·73 per cent. in 1883. The disease gave rise to proportionately greater mortality in towns than in villages, for whilst urban mortality equalled 1·10 per 1,000, in rural circles the ratio was 0·24 per 1,000. The disease was most prevalent in Gya, Sarun, Patna, Chumparan, and Hazaribagh. As usual, the mortality was chiefly borne by infants and children, as 72·27 per cent. of the total mortality from small-pox was contributed by them. In the Punjab, also, mortality from small-pox was greater than during the previous year; but the ratio of 1884, namely, 0·87, is below the average of the preceding five years, which was 0·94. Here the urban mortality exceeded the rural, the ratios being 1·07 and 0·86 respectively. In the Bombay Presidency the disease gave rise to a mortality (0·88 per 1,000) almost equal to that of 1883, but about four times as great as the average of the preceding five years, namely, 0·21. In British Burma the disease prevailed with unusual intensity: it gave rise to 6,102 deaths against 675 in 1883; but the latter year was one of unusual quiescence of the disease. Although causing a large loss of life, it was not widely diffused over the Province, as deaths were reported only in 1·20 per cent. of villages. In the Central Provinces the disease was more prevalent than in any of the three preceding years, giving rise to 4,882 deaths, or 0·55 per 1,000 of population. But this ratio is below the mean of the preceding five years, which was 1·04. In Assam, Berar, Mysore, and Coorg it was less than in 1883. Small-pox.

Fevers gave rise to 3,306,285 deaths against 2,879,659 in 1883; but the latter year was one of diminished prevalence of the disease. The aggregate number Feve

of deaths and ratio of mortality were less in Assam, Central Provinces, Berar, and Coorg than in 1883; in all the remaining provinces they were higher. Of the districts showing a diminished mortality the Central Provinces and Berar are the most conspicuous, and these also showed a remarkable diminution in the prevalence of cholera, as already remarked in a foregoing paragraph. Of the provinces showing an increased mortality the North-Western Provinces with Oudh and the Panjab stand forth prominently. In the former, fevers gave rise to 243,839 deaths in excess of the number of 1883, but the ratio per 1,000 of population for the year under report, 24·35, compared with the mean ratio of the previous five years, 25·54, shows that fevers were not unusually prevalent. In the Punjab the total number of deaths in 1884 exceeded the total of 1883 by 159,371, and the ratio per 1,000 of population of 1884, namely, 24·71, was unusually high, for the average of the preceding five years was 20·15. The disease was most prevalent in the Ludhiana, Umballa, and Karnal districts. It was not until September that a marked rise in mortality was observable, and the maximum number of deaths was reached in October. Fevers gave rise in Bengal to a larger mortality, both aggregate and proportionate, than in any previous year since 1871 when records were first kept. In all, 966,233 deaths were attributed to this cause, against 913,766 in 1883, or 14·60 per 1,000 of population, against 13·81 in 1883, or 12·38, the mean of the previous five years. These increased numbers for the year under report are attributed to improved registration. This may be so to a certain extent, but registration in this Province has not made much progress of late years. The disease was more diffused than during 1883, 64·78 per cent. of villages having recorded deaths, against 57·37 in that year. Although fevers were more prevalent in British Burma during 1884 than during 1883, yet the mortality ratio of the former year, namely, 8·08, differs but little from the average ratio of the previous five years, namely, 7·89. In the Madras Presidency the ratio of mortality, 7·6, is identical with the last quinquennial average. In the Bombay Presidency also the ratio of 1884 is practically the same as the average of the last five years, which is 16·09.

Bowel complaints.

The total number of deaths from bowel complaints, 274,234, exceeds that of the previous year, which was 261,623. The ratios of the present year do not differ much from those of the preceding one except in Berar, where it is only one half, and in the Central Provinces, where also there was a considerable reduction in the number of deaths from these causes. These two provinces, showed also the largest diminution in the number of deaths from fevers. This parallelism between fever and bowel complaint mortalities is not uncommon, and has been noticed in former reports. The seasonal prevalence of these complaints varied in the several provinces; but for India as a whole, July, August, and September are the months during which the largest number of deaths take place.

Injuries.

Injuries give rise to a somewhat larger number of deaths than in 1883, 76,583, against 76,059. The Central Provinces, North-Western Provinces with Oudh, Berar, and Madras, gave rise to the largest number of deaths from accidental causes in proportion to population.

All other causes.

In the report for 1883 it was noted that a progressive increase in the total number of deaths ascribed to causes other than those above considered had taken place since 1881, and it was thought that this indicated a more careful separation of deaths under their proper causes. The result of the year under review supports this view. The total number of deaths included under "other causes" was 953,141, against 889,243 in 1883. If the increasing number of cases recorded under this head be really indicative of improved and more careful registration as supposed, then the results in the Madras Presidency, Punjab, and Burma show improvement as compared with 1883.

Vaccination.

The largest proportion of population successfully vaccinated was recorded in Coorg, where 47·05 per 1,000 are stated to have been protected from small-pox. The next highest ratios were recorded in Berar (37·0), Central Provinces (36·01), and Bombay (30·39), and the lowest in North-Western Provinces and Oudh (12·88) and Burma (19·95). Comparing the protections protected during 1884 with the average annual successful vaccination during the previous five years, the result in the North-Western Provinces

with Oudh alone is unfavourable: in every other province an increased protection has been afforded, though in most cases to a small extent. Estimating the birth-rate at 40 per 1,000 in all provinces, the percentages of births successfully vaccinated were greatest in Berar (72·8), the Punjab (54·4), Bombay (43·9), and Central Provinces (44·3), and lowest in Burma (6·5), Assam (7·0), and Madras (10·8). In Bengal also the ratio was small, namely, 11·1 per cent. In Berar, each vaccinator of the special vaccination establishment performed on an average 2,175 operations, and in the Punjab 2,068. These are the highest averages, whilst the lowest were recorded in Madras (968) and North-Western Provinces and Oudh (987). The greatest success in primary operations was attained in the Bengal Province, where this was equivalent to 99·66 per cent. In most provinces primary vaccination was successful in over 90 per cent. of cases. In re-vaccinations success varied from 15·8 per cent. in Berar to 72·24 in Coorg, or 71·27 in Central Provinces.

In Bengal Proper the prejudice of the people against vaccination is gradually disappearing, and considerable progress has been made in the working of the department. During the year the Compulsory Vaccination Act was extended to several new police circles and towns, and the total number of operations increased from 1,364,642 in 1883–84 to 1,488,296 in 1884–85. Of these 1,402,260 were performed by Government and licensed vaccinators, and 86,036 by vaccinators attached to municipalities, dispensaries, &c. Of the 1,391,598 primary operations performed by the paid and licensed establishment, 1,379,608 were successful, or at the rate of 99·66 per cent., and of 10,662 re-vaccinations 4,163 proved successful, or at the rate of 44·75 per cent. In the vaccinations carried on in municipalities, dispensaries, &c., the percentage of success in primary cases was 94·72, and in re-vaccinations 63·75 per cent. Of the total number thus protected 211,430 were infants under one year of age, and 978,171 were children between one and six years old. But the fact that by far the largest proportion of small-pox mortality was borne by infants and children shows that much still remains to be done for their protection. In the vaccination circles altogether 28·94 per cent. of the population were protected. A large number of operations was performed with bovine lymph either direct from the calf or by arm-to-arm transmission, and the result was, on the whole, satisfactory.

During 1884 the vaccination establishment of the North-Western Provinces and Oudh was strengthened by the addition of 23 vaccinators, and the total number of operations rose to 656,561 from 649,067 in 1883–84, but the average number performed by each vaccinator fell from 1,011 to 987. Primary operations numbered 641,143, and of these 563,864 were successful, or at the rate of 87·94 per cent. against 565,351, or 92·11 per cent. in 1883–84. Re-vaccination is not carried out at all in the first circle. The second and third circles performed 15,418 such operations, of which 4,508 only were successful, or at the rate of 29·23 against 26·96 in the preceding year. The small amount of protection afforded by vaccination during the year is attributed to excessive prevalence of fever and small-pox, defective lymph, and want of energy on the part of the vaccinators.

During 1884–85 the Punjab vaccination establishment was strengthened by the addition to the staff of a Native supervisor and five vaccinators; and the number of operators in dispensaries also increased to 31 from 28 in the previous year. The total number of operations, however, performed throughout the province fell to 583,498 from 633,062 in 1883–84. This decrease in work is attributed to the excessive prevalence of fevers in the autumn months. Of the total operations 544,493 proved successful, which shows that of the population of the province only about 28·9 per 1,000 were protected. In primary operations performed by vaccinators the success was at the rate of 94·78 per cent., in re-vaccinations 41·53; and in operations performed by the dispensary officials, primary operations were successful in the ratio of 91·38 per cent., and re-vaccinations to the extent of 46·79. In most districts primary operations were performed upon children under six years of age. The Compulsory Vaccination Act was in force in the Amritsar Municipality, but here the deaths from small-pox were far more numerous than in any other town of the province. The lymph used was human, partly imported and partly collected in the province. No attempt was made to raise animal lymph locally, as is done in some parts of the country.

During 1884–85 no actual opposition to vaccination was met with in any part of the Central Provinces. Although there was considerable falling off in the number

of operations performed by the dispensary establishment, there was marked increase in those effected by the Government staff, and the total number of vaccinations for the province stood at 415,804 against 410,121 in the previous year. Of these, 400,455 were primary operations, which proved successful in 385,659 cases. The per-centage of success in the vaccinations performed by the regular establishment was 96·56 per cent. in primary cases, and 71·27 in re-vaccinations. In the operations carried on by dispensary officials the success in primary cases was at the rate of 92·20, and in re-vaccinations at 75·00. The per-centage of success in primary cases returned by the vaccinators is probably exaggerated, as in those inspected by the Civil Surgeons or Native Superintendents it never exceeded 92. Compared with 1883–84, the inspection work done by the Civil Surgeons was less, but that done by the Native Superintendents was greater. In all, about 38·27 per 1,000 of the population of the province were protected by vaccination.

Under the reorganisation carried out in November 1883 the vaccination staff of Berar Province was reduced from 64 to 49 operators, but the number of Native Superintendents was raised from 6 to 7. These men were to carry out the work for 10 months in the year, instead of six months, as in previous years, and consequently, notwithstanding a decrease in the number of vaccinators, the results of 1884–85 show considerable improvement both as regards quantity and quality of work done. The operations performed by the special establishment amounted to 93,517, or 14,313 more than in the preceding year. All these, with the exception of 82, were primary vaccinations, and the per-centage of success among them was 95·3 per cent. against 92·9 in 1883–84. Of the 82 re-vaccinations, only 13 proved successful, or at the rate of 15·8 per cent. Besides these, 7,617 operations were done by medical subordinates attached to dispensaries, of which 90 per cent. were successful in primary cases and 47·6 in re-vaccinations. In all, 37 per 1,000 of the population were protected, against about 30 per 1,000 in the previous year. The number of children protected under one year of age was 70,108, or considerably more than one half the total births of the year. The inspection work carried on by the Superintendents was also much more satisfactory than in previous years. Humanised lymph was kept up in all parts of the province, and in the districts of Akola and Amraoti animal lymph was also used to a certain extent.

During the year under report several Medical Officers in British Burma "took a "personal interest in, and worked hard for, the cause of vaccination;" and, in addition to the work done by the Government officials, a large number of vaccinations was also performed by missionaries in various parts of the country. A new district, under the name of Salween, with a population of 30,009, was for the first time brought under operation. This accession, together with the great increase of vaccinations which took place in the districts of Sandoway, Hanthawaddy, Prome, Amherst, Mergui, and Shwegyin, raised the total number of operations performed by the special establishment in 1884–85 to 89,923, from 73,269 in 1883–84. Of these, 82,805 were primary cases, and 7,118 were re-vaccinations with success at the rate of 84·3 and 65·9 per cent. respectively. The average number vaccinated by each vaccinator was 1,427, which varied from 176 in Toungoo to 4,921 in Sandoway. The failure at Toungoo has already attracted the Chief Commissioner's attention, and the Sanitary Commissioner has been directed to inquire into the matter. Animal lymph was successfully cultivated in Rangoon and Akyab, the former town supplying a large quantity to out-stations. In both these towns the Compulsory Vaccination Act was introduced, and byelaws under the Act have been sanctioned. As pointed out by the Chief Commissioner, it is very desirable that vaccinators should be closely watched to prevent them from practising inoculation, and that in future reports the number of successful operations, verified by the Civil Surgeons during their tours of inspection, should be shown. Although taken by itself, the result of dispensary vaccination in the year under review does not appear on the whole satisfactory, yet, compared with 1883–84, it indicates considerable progress. Of a total of 70,431 successful primary cases, only 9,753 were infants less than a year old, and 35,845 were children between one and six years of age.

The vaccination staff employed by the Government of Assam consisted of 169 operators against 170 in the preceding year, but it is satisfactory to find that the number of ex-inoculators who were suspected in former years of having practised inoculation under cover of their licenses was considerably reduced during the year. On the whole, the results of 1884–85 testify to steady and marked progress in vaccina-

tion as compared with the three preceding years. In some places, however, there was a considerable reduction in the number of operations performed; Sylhet and Cachar are examples of this, as also tea-gardens, the returns of which are, however, admittedly imperfect. The results in Sylhet and Cachar are rendered more unsatisfactory by the facts that the working staff in the former district was double that of any other in the Province, whilst in the latter the number of vaccinators was increased by two in the year under review. Of the total number of vaccinations performed durng the year, all but 583 were primary, and the average number performed by each vaccinator was nearly 564. Primary operations only were performed in tea-gardens, and in these the per-centage of success was 64·93. In similar operations performed by the district staff 91·78 per cent. were successful. Inspections were also carried out on a more extensive scale than in the previous year, 41 per cent. of the total operations having been verified during the year, against only 32 per cent. in 1883–84. The Compulsory Vaccination Act was in force in the Municipalities of Gauhati, Dhubri, and Sylhet, and in the Cantonment of Dibrugarh; but the results are still too meagre to warrant any definite conclusion being drawn as to the success or failure of the Act. It is encouraging to notice that the efforts of local boards in promoting vaccination were attended with success. The lymph supply was deficient, and in some cases inferior in quality.

During the year under review there was an increase of eight deputy inspectors and 38 operators to the vaccination staff of the Madras Presidency, and the number of operations rose from 749,038 with 687,175 successful cases in 1883 to 799,311 with 729,119 successful cases in 1884. Of these 133,856 successful cases were among children under one year of age. This shows that, deducting the deaths among children less than a year old, only about 19·5 per cent. of the infants born during the year were protected. Considering the extraordinary prevalence of small-pox, which caused a larger number of deaths than in any year since 1866 (with the exception of 1877), the protection of only 19·5 per cent. of infants and of 23 per cent. of the total population is to be regretted. The dispensary operations were successful at the rate of 79·7 per cent. in primary cases and 47·0 in re-vaccinations; but those performed by the other establishments combined had a per-centage of success at 93·0 and 54·3 respectively.

The average number of vaccinators employed in the Bombay Presidency during the year was 453, and the total number of operations performed by them amounted to 837,163. Of these 777,100 were primary operations with 739,393 successful cases, and 60,063 were re-vaccinations with success only in 39,128 instances. In addition to these, 25,871 operations were performed by dispensary officials. The total number of vaccinations in the Presidency, therefore, during 1884 was 863,034, of which 801,306 were successful. These do not compare favourably with the results of the preceding year, when the special establishment consisted of only 437 vaccinators, and the total number of operations was 878,312 with 823,200 successful cases. The extent of protection afforded was consequently less than in the previous year, the number successfully vaccinated per 1,000 of population in 1884 being 30·39, against 31·01 in 1883. The Compulsory Vaccination Act has been in force in Bombay city for the last seven years and in Karachi for five years, and in both places a large number of children was protected. In most parts of the Presidency vaccination was carried on with human lymph from arm to arm, in the Bombay town with animal lymph only, and in some places, such as Poona, Broach, &c., with both kinds. The number of operations verified was 88·44 per cent., against 40·76 in 1883.

The Vaccination Department of Coorg was remodelled during the year under report. It consisted of one inspector and seven vaccinators instead of one inspector and four vaccinators as before, and it is gratifying to observe that the work done by each one of the establishment was greater than before and of better result. The total number of operations, including those performed by medical subordinates attached to dispensaries, was 10,598 with 9,360 successful cases, equivalent to 88·3 per cent., against 5,330 and 4,596, or 86·2 per cent., in the preceding year. Of the persons protected by vaccination during the year, 900 were infants under one year of age and 4,020 were children between one and six years of age. The proportion of persons successfully vaccinated per 1,000 of population was 47·05, against only 22·64 in 1883–84.

In the British Army 849 men were primarily vaccinated with success in 636 cases, or 74·91 per cent., and in the Native Army 2,358 operations were performed, of which 1,579, or 66·96 per cent., were successful.

Sanitary Works—Military.

The following statement furnished by the Examiner of Accounts, Military Works, shows the particulars of expenditure on military works during the year 1884-85 :—

Military Works.

	Rs.
Original works	20,25,943
Repairs	17,61,009
Establishment	14,34,978
Tools and Plant	49,854
Barrack Department	4,78,246
Total	57,50,030

No information can be furnished as to the details of works executed or in hand during the year as the necessary data are not at present available.

Civil Sanitary Works.

Of the income of the Bengal Municipalities, 87·60 per cent. were expended on sanitary works in 1884, as compared with 34·48 in 1883. It was, however, very unequally distributed. While at Mokameh, Kishoregange, and Burdwan 55·19, 42·73, and 43·10 per cent., respectively, were laid out on sanitation; in places like Hooghly and the suburbs of Calcutta, notwithstanding their large income, only 0·77 and 1·24 per cent. were spent under this head. The principal items of expenditure were, as usual, conservancy, drainage, water-supply, vaccination, slaughter-houses, &c. Under water-supply the outlay of the year was less than 1883. The following were the important sanitary works carried out or taken in hand during the year:—The Burdwan waterworks were completed and formally opened in November 1884. Arrangements were made for the preparation of plans and estimates of an approved scheme of water-supply for Howrah and some of the other river-side municipalities between Howrah and Chandernagore. In Dacca, some improvements were made in the filter beds to prevent leakage, and the water-supply was extended northwards to Nawabpore road. In Bhagalpur, material and plant were being collected for carrying out the water-supply project already sanctioned by Government. The Sarun canal was improved at a cost of Rs. 20,000. Steps were being taken to improve the drainage of Ranigunge. In the city of Moorshedabad, the drainage works commenced in 1883 were completed, and further improvements are under consideration. Estimates and plans for a thorough drainage of the town of Dinagepur were under consideration. In the Midnapore district Rs. 88,600 were expended on the drainage of the *Supai Khal*. Further improvements were made in the drainage of the Nuddea district. Besides these, many sanitary improvements were carried out also in Calcutta and its suburbs. No particular attention seems to have been paid to the improvement of the sanitary condition of villages. In this respect, however, the suggestion of the Magistrate of Shahabad to the effect that Government ought to take special sanitary action in its own villages and assign a per-centage on the rents for the purpose seems well worthy of consideration.

In the towns of the North-Western Provinces and Oudh no sanitary work of any magnitude was executed during the year. Almost all the municipalities in the province devoted a portion of their income to sanitation, the expenditure in most instances being for the maintenance or improvement of existing arrangements in connexion with drainage or water-supply, and in some cases to original works, such as the sinking of wells, construction of masonry drains, culverts, latrines, &c. In the following instances large sums of money were expended on permanent sanitary works:—At Bareilly Rs. 26,004 were spent chiefly on works undertaken for the perfect drainage of the city site. At Saharanpur, a loan of Rs. 50,000 was applied for to carry out a complete drainage scheme for the city. At Meerut, Muzaffarnagar, Hapur, Sirdhana, and Mainpuri, drainage ways were made for effectually removing excessive rainfall from town sites. At Gorakhpur and Azamgarh considerable progress was made in extensive drainage works. A scheme was prepared for the water-supply of Lucknow, and the question of experimental artesian borings was under the consideration of the Government.

Of the sanitary works executed or undertaken during the year in the Punjab, the following were the most important:—At Simla the Sanjauli reservoir, calculated to hold about two million gallons of water, was so far advanced by the end of the year that water could be stored in it. A portion of the Simla drainage scheme, at an estimated cost of Rs. 1,11,345, was sanctioned, and during the year the pipe track was completed. At Amritsar, an extramural drainage scheme for the removal of storm water from the city and suburbs, and for the drainage of certain *jheels* near the civil lines, was in progress. A new scheme for water-works at Delhi, at an estimated cost of Rs. 10,10,279, was sanctioned. The drainage of certain suburbs of Delhi was taken in hand again at a cost of Rs. 15,000. The Bara river, which runs through the Peshawar city, was converted from a filthy channel into a clear stream fit for watering streets, &c. A scheme for supplying pure drinking water to the city of Peshawar was under consideration. Arrangements were made for the supply of pure water to the civil station of Dalhousie. Measures were under consideration for ensuring a pure water-supply to Kasauli. Besides these, minor sanitary works were carried out in all the districts. The total assets of the municipalities in 1884 amounted to Rs. 37,95,192. Out of this Rs. 9,43,989, or above one-fourth, were expended on sanitary works, including vaccination. The Sanitary Commissioner did much useful work by visiting various municipal towns in the province and endeavouring to impress upon the members of the newly elected boards under the Local Self-Government Act the necessity of scavenging their towns on a systematic plan, of futhering vaccination, and in drawing the attention of the public in general to domestic and personal hygiene.

No sanitary works of any magnitude were undertaken or executed during the year in the Central Provinces. Works of minor importance, such as cleaning tanks, wells, and drains, repairing, and constructing latrines, dustbins, &c., &c., were carried out in almost all the districts. The number of new wells constructed throughout the province during the year was 144. In municipalities, Rs. 2,50,803, or 34 per cent. of their total income, were spent on matters connected with public health. At Khandwa a new and more powerful engine was brought into use at the Rameshwar reservoir. With reference to the village conservancy rules recently passed by the Chief Commissioner, many villages were inspected during the year. In some of them it is stated that measures in connexion with pure water-supply, removal of carcases to some distance from inhabited sites, &c., are already being attended to. Some time, however, must elapse before a strict observance of the rules by the village people can be expected. Future progress in this matter will depend much on the interest in it taken by the local officers.

The total expenditure incurred on sanitary improvements in Berar during the year amounted to Rs. 1,57,066. Of these, Rs. 24,173 were spent in civil stations, Rs. 61,149 in municipalities, Rs. 33,053 in non-municipal towns, and Rs. 38,691 in villages. The principal items of expenditure were conservancy, drainage and water-supply. Of the sanitary works executed, or in hand, during the year, the following were the most important. The Kalapani tank, commenced in 1882 at an estimated cost of Rs. 3,02,646, which is intended to supply the town of Amraoti with pure water by means of pipes, was approaching completion. The works in connexion with the Hirgowan tank in the Amroati hills were completed at a cost of Rs. 18,523. The Pahora tank also in the Amraoti district was taken in hand at an estimated cost of Rs. 28,621. The Dhamangaon tank in Ellichpur district was finished at a cost of Rs. 13,490. In Melghat seven anicuts (weirs) were completed at an aggregate cost of Rs. 20,881. In Akola the restoration of the old tank at Janona, to supply Khamgaon with pure water, at an estimated cost of Rs. 96,524, was about to be completed; and pipes from the tank to Khamgaon have been already laid at a cost of Rs. 23,524. At Mardi a tank at an estimated cost of Rs. 16,621 was in progress.

There is not much to record under the head of sanitary improvements in Assam. Of the total income of municipalities, only Rs. 69,177 were expended on sanitary works, including medical relief, against Rs. 83,483 in 1883; and on both drainage and water-supply, the two most important of sanitary works, the outlay of the year was less than in the previous year. The only works of any importance undertaken were the Gauhati waterworks, which are still in progress, and the Goalpara drainage scheme, the main channels of which have been already completed. Minor improvements were carried out in several municipalities, such as constructing or cleaning wells and tanks, &c.

Nothing seems to have been done during the year to improve the sanitary condition of villages in British Burmah, nor were sanitary works of any magnitude undertaken in towns. An elaborate scheme for the drainage of the town of Rangoon, at an estimated cost of 170,346*l.*, or along with a supplementary high pressure water-supply, at 180,035*l.*, was under consideration. Rs. 12,880 were expended in constructing masonry surface drains at Rangoon. At Prome Rs. 1,24,283 were spent on the new water-supply works, which were nearly complete. At Pegu a general scheme of surface drainage was being taken in hand, at an estimated cost of Rs. 25,000. Sanitary works of a minor nature, such as provision of surface drains, latrines, &c., were carried out in most municipalities; and it is satisfactory to notice that the committees of all the larger municipalities were evincing much interest in improving the sanitary condition of their towns.

Of the total income of the municipalities in Madras Presidency, including Madras town, Rs. 11,29,368 were allotted for sanitary purposes for the year 1884–85, but of this sum only Rs. 8,41,328 were expended in the nine months ending 31st December 1884. No new work of any importance was undertaken during the year. All that was done consisted in repairing and cleansing tanks and wells, and in constructing and repairing latrines, drains, roads, dustbins, &c. In the local fund circles Rs. 3,72,946 were sanctioned for sanitary work, but up to the end of December 1884 only Rs. 1,97,457 were utilized in improving the sanitary condition of villages. The works carried out consisted chiefly of constructing and repairing wells, tanks, dustbins, latrines, drains, &c., and improving village sites, &c. The Government has already taken steps to impress upon municipalities and local fund circles the necessity of utilizing all allotments for sanitary purposes during the year for which they are sanctioned, and better results may be expected in future.

The total income of the Bombay municipalities in 1883–84 amounted to Rs. 29,86,674, and of this Rs. 6,60,806 were expended on conservancy arrangements. Although no work of any magnitude was executed during the year, yet a great deal was spent on drains, water-supply, latrines, roads, markets, and other works connected more or less with the improvement of the general sanitary condition of the different localities. The most important of them were the following: At Ahmedabad Rs. 1,639 were expended on drains. At Viramgam Rs. 1,488 on waterworks. At Broach Rs. 2,507 were spent on improving slopes, and Rs. 17,084 on roads. At Surat Rs. 1,157 were spent on latrines, and Rs. 9,899 for extending the public park. At Kalyan Rs. 1,367 were spent in improving Lendi tank. At Ahmednagar Rs. 2,012 were expended on waterworks, and Rs. 8,115 on markets. At Sangamner Rs. 1,911 were spent on latrines and urinals. At Poona Rs. 47,997 were laid out on markets, Rs. 2,767 on cremation ghâts, and Rs. 3,346 on new drains and sewers. At Sholapur Rs. 10,297 were spent on waterworks, and Rs. 1,660 on drains and sewers. At Bagalkot Rs. 4,926 were spent on roads. At Karachi Rs. 6,040 were expended on paving, deepening and cleansing roadside drains and gutters. At Hyderabad the drainage of Jayhakh and Khalian lanes, waste water drains of city services, and cleaning fort tank and Shah Kalam tank were undertaken. The principal items of expenditure for sanitary purposes in local fund circles were construction of new wells and tanks and repairing old ones.

No sanitary work of any magnitude was executed in Coorg during the year. In four municipalities small amounts were expended in constructing or repairing roads, drains, markets, &c. A scheme for the water-supply of Mecara was under consideration.

General Remarks.

Revised form of bill of health.

Under the orders of the Government of India, dated 21st January 1882, Medical Boards were appointed at the chief ports of British India to report weekly as to whether cholera was epidemic or not at these ports, and bills of health to out-going vessels were based on these reports. But as the Board stated simply that cholera was or was not epidemic, without giving the reasons which guided them in forming their opinion, it was thought desirable that something more than a mere statement of opinion should be recorded on their weekly reports. Accordingly, a revised form of certificate was introduced by order of Government, dated 31st July 1885, and it was notified that "Boards should not merely certify whether cholera is 'epidemic' or 'not epidemic,' but "should invariably give some brief description of the character and incidence of the

"disease at the time of report." When the Board certifies that cholera is "not epidemic" clean bills of health may be given in the following standard form:—

"BILL OF HEALTH.

"This is to certify that the ship is at the time of leaving this port in a satisfactory sanitary condition, and that no case of infectious disease dangerous to life exists among its officers, passengers, or crew.

"It is further certified that the town and port of are at present free from epidemic cholera, plague, yellow fever, and all other dangerous epidemic disease."

"*Dated* "*Health Officer of the Port*
"*The* *(or Port Officer).*"

Should cholera however prevail epidemically, the last report of the Medical Board will be attached to the bill of health, which is to certify only to the state of the ship and its officers, passengers, and crew, the last paragraph of the bill of health being omitted.

Absence of cholera at the Haj of 1884.

The complete immunity from cholera enjoyed by the pilgrims to Mecca during the Haj of 1884, together with a diminished prevalence of sickness generally, is most gratifying evidence of the beneficial effects of a stricter attention to sanitation. Vice-Consul Dr. Abdur Razzak in his excellent report on the health of the pilgrims pertinently remarks, with reference to the absence of cholera, that this will doubtless be attributed by some to the increased vigilance displayed by the Turkish authorities during the year in connexion with quarantine, but he proceeds to show that the result may with greater probability be traced to local natural and artificial causes. The sanitary condition of Mecca and Moona was greatly improved, surface cleanliness and conservancy having been carefully attended to. Moreover, the water-supply for the use of pilgrims at Moona was of much better quality. In former years the water drunk by the pilgrims was obtained from tanks, which were filled during the rains, and which at the time of the Haj had lain stagnant for some time. During 1884 these tanks were emptied before the season of the Haj, and the pilgrims were in consequence obliged to buy the cleaner water brought to them from the Zobeidah aqueduct. Slaughter sheds also were erected at distances from one another, instead of being aggregated together as formerly, and arrangements were made for burying the carcases of sacrificed animals, instead of allowing them to putrefy on the surface. The encamping ground was more openly occupied, a larger space having been available owing to the absence of Persian pilgrims, who had for some reason been prohibited attending the Haj. Together with this greater attention to the most elementary rules of sanitation, the weather was unusually favourable; heat was less and cool breezes prevailed at times. It seems, therefore, more reasonable to ascribe the immunity from cholera and the lessened prevalence of disease generally among the pilgrims to these causes than to look for an explanation of the absence of cholera in imperfectly conducted measures of quarantine. The futility of quarantine, even when enforced with every possible rigour, has been demonstrated time after time and has been admitted at the recent international conference assembled at Rome by some of the most advanced contagionists.

Pathological laboratory for special investigations.

The new laboratory, for the construction of which it was stated in the report for 1883 arrangements were being made, has been completed, and now affords facilities for special research in minute pathology. The great importance attached at the present time to germinal pathology rendered it desirable to equip the laboratory with the special apparatus and appliances necessary for researches in this domain. This has now been done. In the meantime, however, during the construction of the laboratory no time was lost in pursuing investigations into the relationship of cholera to Schizomycete organisms, commenced in Calcutta by the German Cholera Commission and continued by the English Commission. Dr. D. D. Cunningham, to whom this investigation was entrusted, has submitted an excellent report on the results he has obtained, which is published *in extenso* in a separate volume.

Scientific memoirs.

Papers on purely scientific subjects were in former years incorporated in the Annual Reports of the Sanitary Commissioner with the Government of India as appendices; but for many reasons it has been considered desirable in future to publish them

separately, the chief of these being that in such form they would be more readily accessible to workers on the subjects treated. The separate volume in which it is proposed to publish papers of purely scientific interest will be entitled "Scientific "Memoirs by Medical Officers of the Army of India." The first volume of what it is hoped will be a yearly series will be published contemporaneously with this report, and may be obtained at Rs. 2 a copy. The publication of such an annual volume will, it is hoped, stimulate Medical Officers interested in biology to work at any branch of this subject in their leisure hours, and afford them an opportunity of publishing the results of their labours. Hitherto it is feared that many officers may have been deterred from undertaking original research for want of a convenient channel of communication. Such a channel is now open to them and Medical Officers will be invited to submit contributions in any department of biology to the Surgeon-General with the Government of India, which, if considered of sufficient merit, will be published in this volume.

The observations on which Dr. D. D. Cunningham's report on the relation of cholera to Schizomycete organisms is founded were carried out during the course of the current year and dealt specially with the following points :—

I.—The association of curved Schizomycetes with materials of choleraic origin.

II.—The presence of similar bodies in other media.

III.—The effects of variations in the nature of the medium in which they are developed on the curved Schizomycetes, occurring in association with choleraic materials. The results arrived at were in accordance with those of other observers in regard to the presence of readily cultivable curved Schizomycetes as a characteristic and even, so far, diagnostic feature of the intestinal contents in cases of cholera. They further agree with previous observations in showing the absence of these bodies from the blood and tissues as examined and cultivated under ordinary conditions. With regard to the occurrence of such bodies elsewhere, it is shown that curved Schizomycetes of various forms, some of which are identical morphologically with the choleraic "commas," are constantly present in the intestinal contents during health, but that these differ from their choleraic allies in not being cultivable under the conditions favourable to the latter. Dr. Klein's observation on the normal occurrence of curved Shizomycetes in the intestinal contents of healthy guinea-pigs are also confirmed, and the frequent occurrence of similar organisms in the water of tanks in and around Calcutta, quite apart from the presence of cholera in the immediate vicinity, is also pointed out. The concluding part of the paper deals with a series of observations showing the extent of variability of form manifested by the choleraic "commas" under the influence of special conditions and corroborates Dr. Klein's statement regarding the occurrence of processes of multiplication in them departing from the ordinary type in the line of fissure being longitudinal in place of transverse to the long axis of the parent organism.

In this volume another paper will be found, "On the Presence of Peculiar Parasitic "Organisms in the Tissue of a Specimen of Delhi Boil," also by Dr. D. D. Cunningham. This is a valuable contribution to the pathology of this affection, forming a continuation of his report, written in conjunction with Dr. T. R. Lewis, "On Oriental "Sore," and published in the Twelfth Annual Report of the Sanitary Commissioner with the Government of India. The following is a resumé of the results obtained.

The "Delhi boil" is described as a simple granuloma, associated with, and very possibly due to, the presence of a peculiar form of parasitic organism. The essential feature in the diseased area is said to consist in an accumulation of lymphoid and epithelioid cells among the normal tissue elements. In the dermis these granulation cells open out and dissociate the normal tissue elements, but do not necessarily go on to the formation of tissue of an adenoid type. The real stroma of the neoplasm consists, therefore, not of any new formation, but of dissociated elements proper to the normal tissue of the part. With a view to ascertaining whether these morbid growths were associated with any special form of bacterial organisms numerous sections were made, and stained in a variety of re-agents. In all sections stained with gentian-violet, and in some stained with fuchsin, peculiar bodies were found to exist constantly in the masses of lymphoid elements. No other dyes affected them. These bodies, stained blue with gentian-violet, varied considerably in size; on an average $\frac{1}{2017}''$ × $\frac{1}{2360}''$; some are described as very minute, but, as a rule, they were considerably larger than the lymphoid elements among which they were situated. In

form they were circular, elliptical, or lobate, sometimes presenting a delicate cell wall, which was, however, at other times not discernible. The stain has a special affinity for the nucleoid bodies contained in these cells, which varied extremely in number. Some cells contained only a single great nucleoid mass, whilst others contained a few of various sizes, or large numbers of minute and fairly equal-sized ones. These cellular bodies were found to be distributed throughout the entire extent of the morbid tissue, but were found in great numbers, especially in the central parts of the continuous stratum of granulation tissue beneath the papillary layer. They were found also in specially large numbers in places where traces of hair follicles were recognisable. Though most numerous in these parts, they occurred also in the deepest parts in the subcutaneous tissues. No opportunities were afforded of obtaining an insight into the developmental history of these peculiar bodies, but Dr. D. D. Cunningham was inclined to regard them provisionally as representing various stages of some simple organism of Mycetozoic origin (probably parent plasmodia or amœbæ). Until their exact nature has been discovered, it is impossible to determine the relation which they may bear to the occurrence of the disease with which they were in this case associated. He writes:—

"There are, however, certain points rendering it possible, if not even probable, that they actually were the specific causes of the disease. In the first place, there can in regard to this specimen be no question of accidental entrance of the parasites into the morbid tissues due to abnormal facilities presented by the surface, for there was no ulcerated raw surface present, and, on the contrary, the horny layer of the epidermis was abnormally thickened and resistent. This in itself is in favour of a belief in their casual relation, as it is hard to see why such bodies should specially attain access to the diseased rather than to the healthy tissues unless some special structural facilities are provided in the former for their doing so. The general features of the distribution of the parasites also point in the same direction, for, as has been pointed above, they are found to occur in numbers varying in fairly close correspondence with the degree to which morbid changes have taken place. Much more significant, however, is the fact of their frequent presence in sites where such changes are only beginning to manifest themselves—in sites where small, isolated aggregations of the neoplasm are interpolated among wide areas of normal tissue elements."

On the whole, it is considered probable that these organisms may find access to the human body through water, and, considering the special numbers in which they are found in the remains of hair follicles and in the neighbourhood of sweat ducts, these structures may be regarded as special channels of access. "It is not claimed that these organisms, if they are the cause of the disease at all at Delhi, are necessarily always so; still less that all "Oriental sores" are caused by them. "All the changes "in the normal tissues," it is stated, "may be reasonably ascribed to mere persistent "local irritation of certain intensity, and it is quite conceivable that such irritation "may be connected with different exciting causes in different instances. Even, "therefore, should it eventually be demonstrated that all cases of such disease "occurring in and around Delhi are invariably and causatively related to the presence "of the parasitic organisms here described, it by no means necessarily follows that "all similar forms of disease occurring in other localities should have an identical "causation. It is quite conceivable that similar morbid changes may arise as the "result of the presence of other forms of parasitic organisms, or may even be "developed apart from parasitic agency of any kind whatever."

Sanitary Conference at Rome.

As these pages were passing through the press, the first volume of the Proceedings of the International Sanitary Conference at Rome was received. The Conference assembled on the 20th May 1885, and met but four times, appointing a technical committee to prepare a series of propositions to serve as a basis of future deliberation at plenary conferences. This first volume deals mainly, therefore, with the work of the technical committee. Notwithstanding the evidence frequently adduced elsewhere and emphatically reiterated at this conference itself, the proceedings of the committee show that the majority of representatives, especially those of Powers bordering the Mediterranean, still firmly believed in the importation from India, by way of the Suez Canal, of all the cholera epidemics which have visited Europe since that canal was opened. And, although there was an evident desire to diminish and mitigate the hardships and delays of quarantine as much as possible, yet there was a firm determination to impose restrictions on shipping from the East to Mediterranean ports at any cost. The most satisfactory feature in the proceedings of the committee is the

evident distrust evinced in the effectiveness of quarantine. Nevertheless, so disinclined were the majority of delegates to acknowledge its futility that the only index to their decaying faith in the measure is to be found in the substitution of the term "*observation*" for *quarantine*. The recommendations of the technical committee to be referred to the plenary conference at its next assembly as far as they interest India may be briefly summarised as follows:—

1. All land quarantine and sanitary cordons are useless.
2. As regards sea quarantine, five days' detention to be substituted for seven, hitherto the minimum in cases where cholera has occurred or is suspected to have occurred on board during passage.
3. The Indian ports will always be considered infected; yet quarantine will not be imposed unless the ship has had cholera on board after leaving port. An inspection by the Health Officer at a port within the Red Sea will be required, when if satisfactory proof be given that there has been no cholera and no grave suspicion of it, and that the ship is in a sanitary state, the ship will at once be granted "free *pratique*."
4. *Pilgrim traffic.*—The 10 days' detention at Camaran will be reduced to five, and this only when the ship is affected or obviously suspected; non-affected and properly equipped ships will, after an inspection of pilgrims on shore and detention of 24 hours for cleansing, be allowed to pass on at once to their destination.

ABSTRACT OF REPORT OF THE SANITARY COMMISSIONER FOR MADRAS FOR 1884.

(Deputy Surgeon General Geo. Bidie, C.I.E.)

European Troops.

The strength of Her Majesty's European troops belonging to the Madras Presidency in 1884 was 13,967.

Sickness and mortality among European troops.

The health of European troops, although disturbed by typhoid fever and cholera, was on the whole very good, and the death-rate lower than any on record in this Presidency. The admissions during the year were in the ratio of 1,106·1, while the average daily sick rate stood at 59·1 per 1,000 of strength, against 991·0 and 59·71 respectively, the rates in 1883. The mortality was reduced to the very low ratio of 8·5 per 1,000, a most satisfactory result considering the great prevalence of epidemic disease amongst the civil population.

The following table shows for a series of years the admissions, daily sick, mortality, and invaliding amongst European troops, and it will be noted that, while there has not been much reduction in the actual amount of sickness, there has, since 1880, been a decided decline in the death and invaliding rates :—

Years.	Ratio per 1,000 of Strength.			Invalided per 1,000 of Strength.	
	Admitted.	Daily Sick.	Died in and out of Hospital.	Change of Climate.	For Discharge.
1870	1,481·5	63·9	19·7	70·4	6·6
1871	1,211·5	56·2	19·1	29·7	12·5
1872	1,352·3	59·7	19·2	26·8	11·2
1873	1,270·8	59·3	18·5	50·6	12·7
1874	1,141·2	57·6	13·4	29·5	8·3
1875	1,096·3	56·9	14·8	60·3	15·5
1876	1,132·9	55·2	16·1	31·9	16·9
1877	1,172·2	58·7	17·2	36·0	10·2
1878	1,379·7	65·8	22·1	36·6	9·1
1879	1,438·7	68·4	16·8	34·3	10·2
1880	1,385·4	68·4	9·9	15·0	8·0
1881	1,164·8	68·2	11·1	18·6	8·8
1882	1,069·4	59·3	10·4	17·6	12·0
1883	991·0	59·7	10·0	20·1	13·6
1884	1,106·1	59·1	8·5	20·9	11·4

Excluding depôts and very small stations, the average daily sick rate per 1,000 of strength in the several cantonments ranged from 72·5 at St. Thomas' Mount to 33·6 at Thayetmyo, and the death-rate from 10·2 in Madras to 2·9 in Bangalore. The depôt at Wellington was fully utilized during the year by sending up young and feeble men likely to break down during the hot season, as well as invalids. Fevers and venereal diseases were the most common causes of inefficiency throughout the force.

There were 12 admissions with 10 deaths from cholera in the stations of Bangalore, Kamptee, Madras, Poonamallee, St. Thomas' Mount and Secunderabad, results which may be regarded as favourable considering the extent to which the disease prevailed amongst the civil population.

The chief incidence of small-pox was at Bangalore, where nine cases occurred with one death. Altogether there were 19 cases in the force against nine in 1883.

Fevers.—There were 762 cases of ague and 104 of remittent fever recorded. At Kamptee there occurred 379 cases of the former and 32 of the latter, and there were also a good many admissions under both heads at Secunderabad and Bangalore. During the past two years there has, on the whole, been a decline in admissions from intermittent fever. There were 129 cases of typhoid fever with 18 deaths, against 94 admissions and 29 deaths in 1883. The admissions in 1884 were, therefore, in the ratio of 11·9 per 1,000 of strength, and the deaths in the proportion of 1·6. As in 1883, the largest number of cases in any one station (60) occurred at Bangalore.

and there were 39 at Secunderabad and 15 at Kamptee. Bangalore is thus becoming notorious for enteric fever, a circumstance due no doubt to some extent to its impure water-supply. Fortunately this is at length to be remedied, as the subject has for some time engaged the attention of Government.

There were 602 admissions with four deaths from dysentery, against 513 and three respectively in 1883. The ratios per 1,000 of strength in 1884 were, therefore, for admissions 55·6, and for deaths 0·37. The admissions were most numerous in Secunderabad and Madras, and there was one death at each of the stations of Madras, Rangoon, St. Thomas' Mount and Tounghoo. Of diarrhœa there were 452 cases in the force with one death. The stations of Secunderabad, Bangalore and Thayetmyo show the largest numbers of admissions for this ailment.

The admissions under hepatic diseases were 310 and the deaths 23, against 422 and 17 in the previous year. The results for 1884 thus give an admission rate of 28·6 per 1,000 men and a death-rate of 2·1.

From sunstroke and heat apoplexy there were five deaths, four from the former and one from the latter cause.

Venereal diseases were more prevalent in 1884 than in 1883, the admission-rate per 1,000 of strength having been 256·1 in the former and 243·2 in the latter. The admission-rates for previous years shows a great amount of inefficiency due to this cause amongst British troops, and that all our efforts to improve matters have been of no avail. In the year under review the admissions were most numerous in Secunderabad, Bangalore, Madras, and Bellary.

Native Troops.

Sickness and mortality among Native troops.

The strength of the Native Army in 1884 was 30,623. These figures refer only to men serving within the Madras Command, Madras troops beyond its range being omitted, as no returns are received from them.

Native troops were not so healthy as in the previous year, the admission-rate per 1,000 of strength in 1883 having increased from 693·9, and the daily sick from 27·7 to 749·3 and 32·8 respectively in 1884. There was a slight decline in the death-rate as compared with that for 1883, although it still stands somewhat higher than the ratio for British troops. This disparity may be partly accounted for by the greater proportion of men somewhat advanced in years serving in the Native Army than in British regiments. The invaliding rate was 21·1, against 26·9 in 1883.

The following abstract gives the main facts connected with the vital statistics of Native troops for a series of years :—

Table showing the Admissions and Deaths amongst the Native Troops since 1868.

	Ratio per 1,000 of Strength.															
	1868.	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.
Admissions	707·4	702·5	630·6	693·9	1,097·9	888·2	772·7	727·7	726·8	632·2	793·2	1,091·2	1,275·9	948·7	906·0	693·9	749·3
Daily sick	29·0	29·3	23·4	22·9	34·7	31·5	30·9	30·7	28·2	28·3	29·7	40·4	55·8	44·6	39·2	27·7	32·8
Deaths in hospital	8·6	10·1	9·4	8·8	9·9	6·4	7·7	9·0	9·8	11·3	11·7	11·8	12·3	13·2	12·4	9·6	9·0
Deaths out of hospital	1·4	2·6	3·6	1·3	2·4	1·6	2·0	1·5	1·2	1·7	1·6	2·5	2·6	3·0	2·6	2·3	2·6
Invaliding	16·4	24·5	25·6	23·3	23·4	30·9	33·5	39·5	37·1	30·5	29·6	36·9	31·6	47·0	39·0	29·0	21·1

The principal causes of sickness amongst Native troops were simple continued, and paroxysmal, fevers 6,861 admissions, skin diseases 2,776, dysentery and diarrhœa (655 + 532) 1,187, rheumatism 653, and respiratory diseases 605. There were also three cases of typhoid fever. The largest number of deaths (29) in the Native Army from a single cause was due to cholera; but respiratory diseases caused 28, remittent fevers 21, diarrhœa 21, and dysentery 16 deaths.

The total deaths from non-eruptive fevers amounted to 39 against 31 in the previous year, and the mortality was, therefore, in the ratio of 1·6 per 1,000 of strength, and 282·0 per 1,000 of admissions, from this class of fevers.

There were 66 admissions from small-pox and five deaths in the Native Army. Although the admissions in 1884 were more numerous than in several preceding years, they must be regarded as moderate considering the very great prevalence of the disease amongst the civil population.

From venereal diseases the ratio of admissions per 1,000 of strength in 1884 was 22·7, against 23·2 in 1883.

The health of the Native troops in the several stations varied greatly. Thus the average daily sick-rate per 1,000 of strength in the detachment in the pestilential climate of the Nicobars was 110·8, while at St. Thomas' Mount it was but 6·3. The stations, omitting small ones, at which there was the greatest amount of inefficiency from sickness were Tounghoo, Secunderabad, Rangoon, Moulmein, Cuttack, and Madras.

The station with the largest death-rate (23·3 per 1,000) was Tounghoo, and that showing the lowest, viz., 0·9, St. Thomas' Mount. Secunderabad had also a very high death-ratio, 22·7 per 1,000 men. There were no epidemics at Tounghoo to account for the great mortality, but 22, out of a total of 63 deaths, at Secunderabad were caused by cholera.

Cholera attacked the troops in the stations of Bangalore, Kamptee, Madras, Rangoon, Secunderabad, Thayetmyo, Trichinopoly, and Vellore; but the cases were few in number except at Secunderabad, where there were 41 admissions, and at Trichinopoly, where there were eight. The risk of cholera at Secunderabad is enhanced by the insanitary condition of the native town,* which is virtually overlapped by the cantonment, and by the unhealthy state of Chudderghat, as the native guard posted there, at the Residency, is very liable to attacks of the disease. In fact the duties assigned to our Native troops in that suburb of Hyderabad seem, in epidemic years, to be as perilous to life as a "forlorn hope," and this in spite of every practicable precaution for the protection of the men. The improvement of the drainage and water-supply of the town of Secunderabad is, however, engaging the attention of Government, and various important reforms are in contemplation. Small-pox appeared amongst the men in 14 stations, but with six exceptions only a solitary case in each occurred. In Bangalore there were 15 admissions from the disease, in Secunderabad 14, in Kamptee 12, and in Rangoon 11.

Jails.

Sickness and mortality in jails.

According to the figures of the Inspector-General of Jails, the prison population on the 31st December 1883 numbered 7,427, and during 1884 the additions to it amounted to 14,908, making a total of 22,345 against 24,200 in the previous year. During 1884 there was a decrease of 15,389 made up as follows:—

Liberated	12,713
Transferred to other jails	2,345
Do beyond sea	126
Escaped	6
Died	147
Executed	52
Total	15,389

The number remaining in confinement at the end of 1884 was thus reduced to 6,956 against 7,437 at the close of 1883, which is satisfactory as indicative of prosperity amongst the poor and labouring classes.

The sick admission-rate per 1,000 of strength of the entire jail population in 1884 was 769·5 and the death-rate 20·2, against 865·3 and 29·4 respectively in 1883. Contrasting the results of 1884 with those of a series of previous years, they were comparatively favourable. The death-rate in 1884 was, with one exception, lower than in any year since 1861–62.

The chief causes of admissions into hospital were intermittent fevers, skin diseases, diarrhœa, dysentery, and diseases of the respiratory organs. Contrasting the prevalence of these ailments with the results for 1883, there was an increase in diarrhœa and a fractional increase in respiratory diseases, but a decrease in the remaining causes of sickness.

There was a decided reduction in the deaths from some of the chief causes of mortality. Thus the death-rate from cholera was 0·9 per 1,000 against 1·9, from dysentery 1·2 against 3·8, and from diarrhœa 3·1 against 5·8 in 1883. Next to diarrhœa, the other diseases showing the highest mortality ratios are phthisis pulmonalis, other respiratory complaints, and dropsy.

* As regards drainage and water-supply.

Taking individual jails, the institutions showing the highest average daily sick-rates per 1,000 inmates are Kurnool (95·7), Chingleput (81·6), Her Majesty's jail, Madras (70·5), Tranquebar (60·6), Mangalore (57·8), Ootacamund European (57·2), Nellore (56·9), and Russellkonda (53·1). Looking at the death-rates per 1,000 of prison population, the highest are recorded against Rajahmundry District Jail (67·3), Tanjore (60·6), Cuddalore (59·1), Ootacamund Native (46·8), Coimbatore District (46·3), and Calicut (40·9).

Cholera appeared in the four jails of Cuddalore, Tanjore, Trichinopoly Central and Vellore Central. There were in all 24 admissions with seven deaths, of which 17 with five deaths occurred in Cuddalore jail. These results may be regarded as satisfactory, considering the great prevalence of the disease among the general population.

Small-pox caused 14 admissions and two deaths, and there were 69 admissions from chicken-pox.

In Chittoor jail, which was otherwise healthy, there were 220 cases of intermittent and 4 of remittent fevers, and the Medical Officer attributes their prevalence to the heavy rain and increase of wet cultivation.

In Chingleput, which is a small jail, the chief admissions were for skin diseases (39), diarrhœa (14), dysentery (5), and continued fever (9).

In Kurnool jail, which is also small, the principal causes of sickness were skin diseases (40), diarrhœa (12), and intermittent fever (8 cases).

In the Cuddalore jail the high death-rate was partly due to 5 deaths from cholera, but there were also 4 casualties from other bowel complaints and 1 from carbuncle. The Medical Officer, in referring to cholera, observes:—

"The first case occurred on the 3rd November 1884, and on the 4th there was another case, after which there was an interval of one week; on the 11th there were two cases, and up to 22nd instant 16 cases occurred and there was an intermission of twenty days, and thence again one case occurred on the 12th December 1884. On the 19th November 100 prisoners were, to relieve the main buildings, sent into camp jail."

The jail at Cuddapah enjoyed a wonderful immunity. Although the building is located in the centre of the town and cholera prevailed amongst the townspeople for a couple of months, not a single case occurred amongst the prisoners.

In the Ootacamund European jail the chief causes of admission into hospital were dyspepsia, diarrhœa, dysentery and fever. With regard to the native prisoners at Ootacamund, the Medical Officer says: "climate, with its daily extremes of temperature, is the main cause of the principal diseases, as diarrhœa, pneumonia, ague (in men already subject to it), bronchitis"; 16 cases of chickenpox, the origin of which could not be traced, also occurred at Ootacamund.

In the Penitentiary at Madras there were two outbreaks, aggregating 18 cases of chicken-pox, viz., one in the early part, and one towards the end, of the year.

Regarding Tanjore jail the Medical Officer remarks: "the general health of the population of this jail during 1884 has not been satisfactory. The prevailing diseases were dysentery, fevers and diarrhœa." There were 3 case of cholera, of which 2 proved fatal, amongst the prisoners, and the Medical Officer remarks: "No cause could be assigned for the occurrence of these cases." With the disease ravaging the general population on all sides, the only wonder is that the prisoners suffered so little.

In Trichinopoly Central Jail, which has for some time been remarkable for the great mortality amongst the prisoners, the death-rate per 1,000 of population in 1884 was 17·4. In 1880 the death-rate was only 33·6, but in 1881 it rose to 121·8, in 1882 to 162·5, and in 1883 it was 55·2. The sudden and alarming increase in 1881 was partly owing to an outbreak of cholera, which caused 84 admissions and 32 deaths, but the greater bulk of the unusual mortality was due to dysentery (44 deaths), diarrhœa (19), and dropsy (12), all diseases indicative, when unduly frequent, of defects in the food and water supplies. In 1882 the warnings of alimentary errors were still more pronounced, as out of a total of 143 deaths in the jail 119, or 83·2 per cent., were due to diarrhœa (58), dysentery (52), and dropsy (9). After much correspondence and inquiry, the prevalence of bowel complaints was ascribed to the use of badly-prepared and insufficient ragi rations. One remarkable circumstance connected with the outbreak of dysentery and diarrhœa was, that the female convicts, although using exactly the same diet as the men, escaped. This immunity was attributed to the women having managed to get better weight in drawing rations and to their being more skilful cooks than the males. With an improved diet and special care in other respects, the death-rate in the jail fell to 55·2 per 1,000 in 1883, and last year it was, as already stated, but 17·4. These results are so far satisfactory, but there are certain features in the history of the

extraordinary sickness which would seem to indicate that there was probably more than one cause in operation, and special attention should continue to be given to the water-supply as well as to the food.

In the six central jails the admission, average daily sick, and death-rates per 1,000 of inmates were as per margin.

Central Jails.	Admission-rate.	Average Daily Sick-rate.	Death-rate.
Cannanore	1,134·7	41·9	19·2
Coimbatore	490·1	17·6	24·9
Rajahmundry	1,227·1	40·1	17·1
Salem	718·3	19·5	7·6
Trichinopoly	385·4	15·5	17·4
Vellore	488·3	19·3	49·7

Rajahmundry shows high admission and daily sick-rates with a moderate mortality. The chief causes of sickness in this jail were intermittent fever (477 cases), diarrhœa (63), dysentery (27), dropsies (27), and respiratory diseases (20).

Cannanore also shows a large amount of sickness, but a low death-rate. The principal causes of admissions were intermittent fever (55 cases), diarrhœa and dysentery (53), respiratory diseases (21), rheumatism (23), and skin diseases 103.

The highest death-rate pertains to Coimbatore jail, but was not due to epidemic disease or any special cause.

The central jails were marvellously free from cholera, as only four cases occurred in the whole group, viz., two in Trichinopoly and two in Vellore.

General Population.

Vital statistics.

The important work of registration was still carried out as in former years, viz., under the supervision of the authorities in municipal towns and by the *karnams* in villages. As regards the statistics of the former, they are now fairly reliable, and the results from the latter also show signs of improvement. The duties of registration are, however, so mechanical and apparently purposeless to ignorant men, that they will only be made to realise their importance by the interest taken in the work by district officials when on tour, and by occasional inspections of the registers. The population figures are, in every instance in this report, those obtained by the census of 1881. The average population per square mile for the whole Presidency was 220·6.

The births numbered 827,381, and were in the proportion of 29·3 per 1,000 of population sending in returns against 27·7 in 1883. The birth-rate in 1884 was the highest on record in this Presidency, and is, it is believed, nearer to the true ratio than any hitherto obtained.

As in 1883 and previous years, the births in 1884 were fewest in the first and second, and most numerous in the third and fourth quarters of the year. Of the total children born, 423,108 were boys and 404,273 girls; so that 104·6 males were born for every 100 females. As already mentioned, the average birth-rate for the Presidency was 29·3 per 1,000 inhabitants, but the rates in the several districts ranged from 17·1 on the Nilgiris to 41·4 in Chingleput. On looking at previous returns, it is found that the average birth-rate on the Nilgiris during the past 10 years has been 17·1 per 1,000 of population. This comparatively low rate is no doubt, to some extent, due to imperfect registration, and perhaps to some extent to the rigors of climate; but I am credibly informed that it is common for low-country natives living on the hills to send their wives to the plains to be confined. With three exceptions, the births in the districts were more numerous than the deaths, the excess ranging from 19·9 per 1,000 of population in the conjoined districts of Bellary and Anantapur to 0·9 on the Nilgiris, while the mean excess for the Presidency was 6·2 per 1,000. The districts in which the deaths exceeded the births were Godávari, Tanjore, and Tinnevelly. In the Godávari district the excess of mortality amounted to 3·6 per 1,000 of population, and was principally due to the large numbers of deaths from small-pox and fevers. In Tanjore and Tinnevelly the disturbing cause was cholera, and the excess of deaths over births was 7·7 per 1,000 in the former and 3·5 in the latter district.

The deaths numbered 650,335, being at the rate of 23·1 per 1,000 of population against 19·0 per 1,000 in 1883. The increase in the death-rate was mainly due to the prevalence of epidemic disease, but partly to improved registration. The following table shows the mortality which has taken place during each of the past 16 years, and

excluding the famine period, it will be remarked that the death-rate was unusually high in 1884.

Years.	Population for which returns were received	Deaths.	Death-ratio per 1,000	Years.	Population for which returns were received	Deaths.	Death-ratio per 1,000.
1869	24,633,127	451,981	18·3	1877	29,209,542	1,556,812	53·2
1870	24,125,526	451,020	18·6	1878	29,122,205	810,921	27·8
1871	24,555,046	444,371	18·0	1879	28,991,267	549,390	18·9
1872	30,147,779	501,482	16·6	1880	28,778,097	454,101	15·7
1873	30,287,842	506,894	16·4	1881	28,676,375	465,682	16·2
1874	30,360,221	516,848	17·0	1882	28,887,111	470,700	16·2
1875	30,278,908	641,260	21·1	1883	28,503,100	541,930	19·0
1876	29,157,056	680,384	23·3	1884	26,151,952	650,335	25·1

There were 105·6 male deaths for every 100 deaths of females; or to put it according to population, the mortality amongst males was at the rate of 23·9, and amongst females in the ratio of 22·2, per 1,000. The death-ratios in the several districts varied greatly. Thus in Nellore and Ganjam it was 14·5 per 1,000, while in Tanjore it stood at 35·7.

The deaths according to age show a large infantile mortality, a sure indication of bad sanitation. Improper food and exposure are also causes of infantile sickness and mortality amongst the poorer classes, and large numbers of children perish from the great epidemics of the country. The total deaths for the year of children under one year of age amounted to 141,872, being in the ratio of 171·4 per 1,000 to the total births. From infancy up to 15 years of age females have obviously a better chance of life than males, but from 15 to 30 marriage and child-bearing reverse the state of affairs. From 30 onwards the females have again the superiority as regards expectation of life. These results are not only interesting as facts, but as a test of the approximate correctness of the statistics.

The statistics of deaths from the chief causes of sickness according to districts and towns of over 10,000 population show that in 1884 the death-rate per 1,000 was, from cholera 2·6 against 1·2, from small-pox 2·1 against 1·3, and from fevers 7·6 against 7·1 in the previous year. 1,514 persons committed suicide, of whom 870 were females and 644 males. 2,290 lives were lost by snake-bite and the attacks of wild beasts. Looking at the relative mortality to population in town and country it appears more than twice as many died from cholera in towns as in villages, and that small-pox was also slightly more fatal amongst the urban residents. Fevers, on the other hand, show a mortality of 7·8 per 1,000 in rural districts against 5·2 in towns.

The following abstract shows the chief causes of death for a series of years, and it will be noted that the great scourges of the population of Southern India, viz., cholera, small-pox, and fevers, were unusually active in 1884.

Years.	Total Deaths.	Cholera.	Small-pox.	Fevers.	Bowel Complaints.	Injuries.	Other Causes.
1866	600,106	200,961	23,106	110,102	—	9,047	256,890
1867	372,026	33,205	27,997	112,514	—	8,613	189,790
1868	390,959	8,036	34,330	105,692	—	9,242	233,659
1869	451,981	21,034	17,448	132,346	—	9,310	271,843
1870	451,020	55,867	11,252	151,027	—	12,325	220,549
1871	444,371	17,656	20,823	192,469	38,928	15,323	159,172
1872	501,482	13,247	39,074	214,148	39,387	15,150	180,476
1873	506,894	840	51,784	222,843	36,392	14,251	180,784
1874	516,848	313	48,348	226,220	37,993	13,065	190,914
1875	641,260	94,546	24,775	252,042	37,484	12,421	219,992
1876	680,384	148,193	23,469	230,992	138,176	11,175	229,279
1877	1,556,312	357,430	88,321	469,241	133,366	16,460	491,494
1878	810,921	47,167	56,360	374,443	48,083	15,007	269,861
1879	549,390	13,296	17,640	285,477	23,218	12,619	196,940
1880	454,101	613	14,529	209,940	19,622	10,845	198,552
1881	465,682	9,446	15,776	203,542	15,961	11,527	206,430
1882	470,700	23,604	20,159	188,561	19,958	11,611	206,807
1883	541,930	36,284	37,975	203,786	22,098	11,509	230,278
1884	650,335	75,476	61,247	215,977	28,775	11,502	257,358

The great epidemic of cholera which invaded Southern India in 1875 lingered till the close of 1879. Its final ravages were mostly confined to the northern districts, but by the month of December it had died out, and the year 1880 began with the large population of Southern India entirely free from the disease. Throughout the year only a few cases were reported and these chiefly from the northern parts of the Presidency. During the first three quarters of 1881 a similar immunity was experienced, except in the north, where there was a slight revival of the disease, but in October epidemic cases began to appear in Trichinopoly, Bellary, North Arcot, Salem, and Coimbatore. The year closed with cholera prevailing in all the districts south of Madras and with a total mortality of 9,446. In 1882 the disease continued to prevail in the southern districts, and also to some extent in Ganjam and Vizagapatam. The epidemic was most severe in Tanjore, Madura, Tinnevelly, and Trichinopoly, and the greatest numbers of deaths occurred in January, February, March and December. The total number of cholera deaths registered during the year was 23,604. In 1883 the disease had all but died out in the extreme north of the Presidency, and while it still continued very virulent in the south, it began to advance along the coast north of Madras and to show a tendency to invade the inland districts of Cuddapah, Bellary and Anantapur. During the last quarter of the year it was raging in Nellore, and had given the Kistna district a warning of its approach. In 1883 the mortality was greatest in the months of January, February, July, November and December, and the total deaths for the year numbered 36,284. The districts which suffered most were Tanjore, South Arcot, Tinnevelly, Trichinopoly, Salem and Coimbatore. Cholera.

Throughout 1884 cholera prevailed in all the districts of the Presidency except South Canara, which completely escaped. Its incidence in Ganjam, Vizagapatam, Kurnool and the Nilgiris was also very slight. Tanjore again bore the brunt of the epidemic, the cholera deaths in this unfortunate district for the year having amounted to 23,671, giving a death-rate of 11·1 per 1,000 of population. The long continuance of the disease in Tanjore and the heavy mortality caused much anxiety to Government, who accordingly invited the special attention of the Surgeon-General and of the Sanitary Commissioner to the subject. From the reply of the former it appears that during the last 18 years in which registration has been in force there has not been a single year without cholera deaths in this district, and the disease, he thinks, is "in some degree endemic in the locality." "The conditions of soil and water in Tanjore are," it is stated, "very similar to those in Lower Bengal, where cholera is "endemic, though the climatic conditions of Bengal and Tanjore vary considerably. "Experience shows that in every new epidemic of cholera the disease will linger "longer in Tanjore than anywhere else." The Surgeon-General further observes: "I believe that the habits of the people and their mode of life in the delta portions "of the district largely contribute to the upkeep of cholera in their midst. They live "in the midst of irrigated lands, and, when the rivers have dried up, take very little "care of the drinking water supplies. While the district is a wealthy one regarding "its agricultural produce, the actual labourers are very poor and live in wretched "hovels built on a damp porous soil."

Dr. Furnell, my predecessor as Sanitary Commissioner, paid a special visit to the district, and after his inspection stated it as his belief, that the cause of the continued prevalence of cholera in the Tanjore district "was most probably owing to the "peculiarly contaminated water-supply upon which the people are dependent." In describing the sources of potable water he says, "but the peculiarity of the water-"supply and the habits of the people favour in every possible way the propagation "and retention of the disease. The beds of these water-courses in the dry weather "are used as *places d'aisances;* but when they contain water, the banks are used, and "the individual proceeds at once to wash his person in the water. These water-"courses feed the tanks, and on these tanks the people in almost all the towns and "villages of Tanjore depend for their drinking-water. Moreover, not only are these "tanks filled with a water thus open to contamination, but they are themselves still "more polluted in every possible way. The women bathe, wash their clothes *and the* "*clothes taken from sick people* in them, and take home large, bright, clean chatties of "the filthy fluid to drink and cook with. At a meeting of the Municipal Commis-"sioners at Tanjore, I placed upon the table six samples of water taken from different "tanks in the town, and one sample of ordinary filtered drinking water from the house "of a European gentleman. The Native Commissioners could scarcely believe that "the green offensive fluids exhibited—one especially from the Iyenkulam—were "samples of the ordinary drinking-water of the people." He suggests that carefully conserved wells should be constituted for tanks, which are so liable to pollution, and

would even go a step further by having in the larger villages pumps to raise the water into reservoirs, from which it might be drawn by stop-cocks.

These observations of the chief medical and sanitary authorities appear to fully explain why cholera should be so severe and persistent in Tanjore. The general death roll of the Presidency will show how much has yet to be done to protect the people of Southern India from epidemic disease, and that our efforts must not be confined to periods when sickness is prevailing, but be continuous and systematic. Fortunately, too, the sanitary precautions which have been found most effectual in warding off cholera are equally valuable for the prevention of other diseases.

In offering these remarks, I have been placed at a disadvantage from not having been in charge of the office during the year, but this will be fully compensated for by the special report on the subject which Dr. Furnell has promised to submit.

Small-pox.

In 1884 small-pox prevailed in every district of the Presidency, and the mortality from it was unusually heavy. The death-rate was 2·1 per 1,000, a higher ratio since 1871 except 1877 when it reached 3·0 per 1,000.

The returns since 1871 show that the disease is subject to periods of repose and severe outbreaks. The latter do not appear to occur with any regularity, but are no doubt influenced by certain atmospheric states and any conditions that lower the vital powers of the general population. Where such a combination occurs—and there are at the same time large numbers of young people unprotected or imperfectly protected by vaccination—we have a severe outbreak, to be followed by a lull till similar conditions again occur. But the disease also varies in the malignancy of its type, as we know that in some of the former outbreaks in Europe it was almost as fatal in its ravages as the plague. Bad sanitary conditions are conducive to severity of type, and there can be no doubt that the malignancy of the epidemic in 1883-84 in Madras town, was aggravated by the crowded and filthy state of parts of Black Town.

Of the total deaths, 39,292—or nearly 64 per cent.—were in children under 12 years of age. The liability of the young to small-pox is still further illustrated by the results during the severe epidemic of 1883–84 in Madras town, as 74 per cent. of the total deaths occurred in children under three, and over 21 per cent. in children above three and under 12 years of age.

Excluding Madras, which only embraces the town and which will be specially referred to hereafter, it appears, that the disease was most severe in the Kistna and Godávari districts, the death-rates in these having been respectively 6·7 and 6·3 per 1,000 of population. Taking these results as a measure of the number of unprotected persons, vaccination requires to be energetically pushed in both these districts. Chingleput, South Arcot, Kurnool and Malabar show death-rates ranging from 3·2 per 1,000 in the two first named to 2·3 in the last. Of the total of 61,247 who died from small-pox throughout the Presidency, 31,296 were males and 29,951 females. The district in which the lowest death-rates occurred were the Nilgiris, Ganjam, Coimbatore, and Cuddapah. The disease was most prevalent and most fatal during the first seven months of the year.

In the town of Madras small-pox assumed an epidemic form in the two last quarters of 1883, and in the first quarter of 1884 it was so severe that Government deemed it necessary to appoint a Special Health Officer as a temporary measure, and to render the vaccination of children above three and under 12 years of age compulsory. During the first quarter of 1884 the deaths in Madras from small-pox numbered 3,157, and were, therefore, in the ratio of 7·7 per 1,000 of population. The outbreak reached its climax in March, in which month the mortality amounted to 1,256. In April there was a marked decline, and, by the close of the second quarter, during which 804 deaths occurred, the epidemic was practically at an end and public fear abated. As already stated, the disease was most destructive amongst children, and, as might be anticipated, it raged with greatest severity in the most crowded and dirtiest quarters of the town. Owing to native habits and prejudices, it is no doubt difficult to carry out in such cases the isolation of the sick, but in my opinion strenuous efforts should be made whenever small-pox invades a town or village to enforce this salutary measure. Such an arrangement in this country need not involve any great expense, as sheds or pavilions, with leaf or grass roofs and partial walls of matting, will meet all requirements. In the report of the Special Health Officer it is stated, "there was no attempt "at isolation in the houses of the affected, and persons suffering from all stages of the "disease might have been seen in the streets lying in the sun, and when convalescent, "but still centres of infection, moving about the crowded bazaars of the town or at "the railway stations." Under such circumstances and with a large section of the

population, especially the young, unprotected by vaccination or previous attack, it is not surprising that the disease was so prevalent and fatal. The total mortality in the town during the epidemic of 1883–84 was 5,284, or 13·0 per 1,000, and in 1884 the deaths numbered 4,064.

One good result that came out of the severe outbreak was the impulse which it gave to vaccination amongst all classes of the community.

Fevers.

As in the case of small-pox and cholera, fever was also unusually prevalent and fatal. The disease in some form was most fatal in the districts of Kurnool, Vizagapatam, Nilgiris, Cuddapah, South Canara, Ganjam, Malabar, Madras (town), Godávari and Kistna. In this group the highest rate of mortality was 15·1 and the lowest 9·0 per 1,000 of population. In the other districts the death-rates varied from 7·7 to 1·9 per 1,000. In 10 districts fever was more prevalent than during the preceding five years, and in the others less so. The total deaths from fevers during 1884 numbered 215,977 (111,246 males and 104,731 females), being at the rate of 7·6 per 1,000 of population. Fever was most fatal in the cold months of January, November, and December, but the deaths were also very numerous in the third quarter of the year. That a chill may develop an attack of fever is a well-known fact, but that there is a veritable malaria in most cases no one can doubt.

Bowel complaints.

The deaths from bowel complaints in 1884 numbered 28,775 against 22,098 in the preceding year. When cholera is epidemic bowel-complaints are more frequent than usual, but at the same time there cannot be a doubt that some deaths due to cholera are registered under the milder term. Even in military statistics, which are entirely in the hands of medical officers, a tendency is sometimes observed to avoid the more formidable name of cholera.

Deaths were most numerous in the months during which cholera was most prevalent. The districts showing the largest death-rates per 1,000 of population from bowel-complaints were Madras (town), Chingleput, South Canara, Malabar and Tinnevelly.

Injuries.

The deaths from these causes amounted to 11,502 against 11,509 in 1883, and were fewer in number than in any preceding year since 1880. In the year under review 1,514 are attributed to suicides, 861 to wounds, 6,837 to accidents, and 2,290 to snake-bites and the attacks of wild animals.

Vaccination.

During 1884 the operations of the Vaccination Department, past and current, were rigorously tested by the great epidemic of small-pox, which exhibited in many quarters an unusual malignancy of type and a corresponding infective power. Unfortunately we have no means of ascertaining the extent to which the protective influence of vaccination was manifested, but we may, from experience elsewhere, feel perfectly sure that it had the usual effect in restricting the spread and modifying the character of the disease, and in saving life. It would, however, be satisfactory at this stage of the history of preventive medicine in India, if we could collect some reliable data as to the actual value of our past vaccination operations. A good deal might be done in this direction if, in the case of admissions for small-pox into civil hospitals and dispensaries, the number and character of the vaccination marks borne by the patients, and the results of treatment as to death or recovery, were in each instance recorded. An inquiry of this nature would prove an efficient test, and in course of time would give us a large amount of valuable information, which sooner or later is certain to be required for public purposes. Vaccination unfortunately does not always confer the full protective influence which it is capable of exerting. To do this, the lymph must be good and the operation properly performed. Climate and protracted humanization exercise a deteriorating influence on the vaccine, while time reduces in the individual the amount of protection originally conferred, rendering a repetition of the operation necessary. Again, the number of arm-marks has a most important bearing on the validity of vaccination. An inquiry of the kind suggested would therefore, to some extent, show how far the conditions of thorough vaccination have been fulfilled amongst the general population; and, making allowance for the agency it has had to work with, and the obstacles encountered, I do not think that the Vaccine Department need shrink from the investigation.

That the people generally in India should be more or less averse to vaccination is hardly to be wondered at, considering that even in England it has been found necessary

to render it obligatory by law, and that, although there exist overwhelming proofs of its efficacy, there are people illogical enough to contend that it is valueless as a protection against small-pox. In fact the marvel is that the common people in this country are not more opposed to an operation which to some extent comes in contact with religious scruples, and of which the advantages are not always immediately obvious. Possibly their familiarity in some districts with inoculation with small-pox virus, has to some extent smoothed the way for the milder operation of vaccination. If we could only now get the educated classes of the native community to realize the inestimable value of vaccination, and to take an active interest in a matter of such consequence to all classes, the progress of the prophylactic would be much more satisfactory, and they would probably be the first to ask Government for some measure to render it compulsory.

I am old enough to have conversed with people at home who lived prior to the general introduction of vaccination, and who resided in a remote district to which small-pox inoculation had never penetrated: and there can be no doubt that Jenner's discovery was for some time regarded with nearly as much suspicion by the people at large in some parts of Great Britain, as it now is in India. And yet, at the time the conversation was held, vaccination was deemed as necessary for a child as the rite of baptism. We have no reason to despair therefore, I think, of vaccination becoming in due course more popular in Southern India.

There was an increase of two first-class deputy inspectors, six second-class deputy inspectors, and 38 vaccinators to the strength of the establishment, as compared with the numbers in the previous year. The augmentation in both the inspectorial and vaccinator grades was made, because the ranges in some districts were too large, or to meet the increased demands for vaccination due to the great prevalence of small-pox.

The total number vaccinated was 803,469 against 753,589 in 1883, making an increase of 49,880 in favour of 1884. Of the operations, 773,118 were primary and 30,351 secondary, so that the former were 36,456, and the latter 13,424, in excess of the corresponding results in 1883. The departments in which an increase occurred were Local Fund (26,598), Municipalities (16,538), dispensaries (9,339), and the Army (2,699). A great impetus was given to re-vaccination by the prevalence of small-pox. In Government, cantonments, native states, and medical subordinates the operations were less by 4,490, 393, 246, and 165 respectively.

The general rate of successful operations in 1884 was 91·2 per cent. against 91·7 per cent. in 1883. Taking primary and re-vaccinated cases separately, the ratio of success for the former was 92·6 per cent. against 92·7, and for the latter 54·4 against 46·4 in 1883. In primary vaccination the highest amount of success (97·1 per cent.) was obtained by Government vaccinators, and the lowest (59·0 per cent.) by medical subordinates. In cases of re-vaccination the greatest success (89·6 per cent.) was obtained in the European army, and the lowest (28·1 per cent.) again by medical subordinates.

Infantile vaccination continued backward, as the total number of successful operations performed by Local Fund and Municipal establishments was in the ratio of 15·4 per cent. on births, against 15·7 in 1883. The largest number of successful cases (375,687) was in children over one and under six years of age and in those above six years (204,658), but the latter shows a decline of 12,732 as compared with the result for 1883. Contrasting the work of establishments for the two years with respect to infantile vaccination, there was an increase under every head in 1884 except in the case of Government vaccinators.

Compulsory vaccination was brought into force in the city of Madras on the 23rd November 1884. Eight vaccine depôts were opened in various parts of the town to give the people the necessary facilities for complying with the terms of the Act. Supplies of lymph from calves were always available, and so far the results were satisfactory.

Sanitary Works.

Municipalities. No new work of an important nature was undertaken during the year in the Municipalities. All that was done consisted, as usual, in the repairing and cleansing of tanks and wells, and in the repair and construction of latrines, drains, roads, dust-bins, markets, slaughter-houses, &c.

Drainage, Water-supply and *Conservancy.*—No change has been made in these during the year. They were much the same as reported last year. The sources of water-

supply were the same, chiefly tanks and wells, and, in some municipalities, rivers and irrigation channels. Year after year greater attention is paid and care taken to conserve and preserve the sources supplying drinking-water from pollution. Generally speaking, there is no regular system of drainage. The existing drains consist chiefly of side-cuttings for surface drainage only. In some towns, however, pucka masonry drains exist. Cesspools abound and drainage from houses flows into these, or into the backyards, or into the streets, or into the side-cuttings. The system of conservancy was the same as last reported. The street sweepings, other refuse matters, and contents of latrines and dust-bins were removed daily by scavengering establishments maintained for the purpose, and carted away beyond municipal limits and disposed of as usual, either by burying in trenches, being thrown into fields, sold as manure, or consumed in cinerators.

On the whole it may be said that of late sanitation has made some progress in municipal towns. Much still remains to be done and there is ample room for improvement, but as we notice that the work done year after year is progressive, we may reasonably hope that the evils existing at present in many of the towns will be gradually removed.

The total estimated income of all the municipalities, Madras excluded, amounted to Rs. 19,27,462, which represents an incidence of Rs. 1-7-3 per head of population. The incidence in 1882–83 was Rs. 1-3-3 and of 1883–84 Rs. 1-4-9; thus it will be seen that there was a gradual rise in this respect since 1882–83. The excess in the year under review over its predecessor amounted to 2 annas 6 pies, by which means the income increased from Rs. 17,20,210 to Rs. 19,27,462, and with this increased income the sanitary allotment also was raised from Rs. 5,71,199 to Rs. 6,54,536, the difference in favour being Rs. 83,337. Taken as a whole, the allotment may be considered as adequate; it yields a per-centage of 33·9 to income against 33·2 in 1883–84. Individually considered also the allotments made by each town except five appear to be fair. In Cocanada (19·6), Mangalore (19·5), Calicut (10·4), Vizagapatam (10·0), and Pálghat (8·9), the per-centages are low and below the average. In 1883–84 Ootacamund and Kumbakónam stood first on the list, with proportionately high sanitary allotments. In 1884–85 also they maintained their positions. The per-centages varied from 8·9 in Pálghat to 66·3 in Ootacamund. Next to Ootacamund and Kumbakónam (59·8) come Salem with 55·0, Madura 52·9, Trichinopoly 48·0, Coonoor 44·6, Tinnevelly 43·6, Tuticorin 41·7, and Tanjore 40·1. In 15 towns the per-centages were between 30 and 40, in 18 between 20 and 30, and in the five others they were below 20 down to 8·9 in Pálghat.

Of the total sanitary allotment, Rs. 3,84,751 were spent in the nine months of the year ending December 1884, leaving over Rs. 2,69,785, or something more than one-third, to be spent in the following three months of the year in 1885. Taking the figures for 1883–84, which represent the transactions for the whole year, it is seen that Rs. 5,41,644 out of an allotment of Rs. 5,71,199 were spent, leaving Rs. 29,555 unutilized

Local Fund Circles.

In 1883 the Local Fund Circles in the presidency were 30 in number, accounted for by some districts being divided into two or more circles; but in 1884, by a notification published in the *Fort Saint George* and *District Gazettes*, the districts of North Arcot, Ganjam, Godávari, Kistna, Cuddapah, Tanjore, Madura, Tinnevelly, and Salem, were declared to be Local Fund Circles, *i.e.*, the separate circles which each of them contained were combined and the whole district formed into one circle; thus there are now only as many circles as there are districts, and these are 21 in number excluding Madras. Sanitary reports were received from all of them.

Water-supply, Drainage and Conservancy.—There is nothing particular to note in these respects. The sources of water-supply were the same as those formerly reported upon, viz., tanks, wells, rivers, irrigation channels and canals, and in the generality of instances the quality is favourably reported upon. Greater efforts are being made year by year to conserve some of the principal sources for drinking purposes only, by the employment of watchmen to prevent them from being polluted. Except in a few cusbah towns where some stone drains exist, the drainage is mostly very primitive, consisting of ditches cut in the soil in the sides of the streets and thoroughfares, and house drainage either flows into these, into cesspools, or into the backyards where it soaks into the soil. In last year's report a retrograde movement was noted in conservancy; during 1884 it appears to have fallen still further back. Out of a total of 52,003 villages only 565 were conserved, against 576 in 1883. This backwardness is observable in 6 out of the 21 circles, viz., in Anantapur the number of villages

conserved fell from 13 in 1883 to 7 in 1884, in Chingleput from 17 to 14, in Coimbatore from 79 to 35, in Malabar from 6 to 3, in North Arcot from 28 to 18, and in Tanjore from 39 to 37. Anantapur, Tanjore and Trichinopoly figure in the reports for the past three years also with deficient conservancy year after year. Now that Act V. of 1884 (the Madras Local Boards Act) provides for the prohibition and removal of obstructions and the cleansing of tanks, streams, wells, and unwholesome buildings and lands in all rural areas, it may be expected that greater attention will be paid to village and town sanitation under the powers conferred by it.

Sanitary works.—Details of the sanitary works executed in each circle during the year are given in the abstracts of the sanitary reports. They consisted chiefly in the sinking of wells and excavating tanks, in the erection of latrines and dust-bins, improving and repairing drains, cleansing tanks and wells, removing rank vegetation, improving village sites, &c., and some other minor works. In some circles more was done than in others; in three districts—Malabar, Nellore, and Nilgiris little or nothing seems to have been done. The amount of work executed in any district may be gauged from the amount expended on sanitation. In this way North Arcot, Tanjore and South Arcot stand high on the list. The sanitary expenditure in them amounted to Rs. 20,005, 16,230 and 15,718, respectively.

The aggregate available income (one-third of the land cess) for the year 1884–85 amounted to Rs. 14,02,971, against 13,84,617 for 1883–84, *i.e.*, the districts as a whole were richer by Rs. 18,344 during the year under review than its predecessor. Of this amount, Rs. 3,72,946, or 26·5 per cent., were allotted for sanitation, against Rs. 3,99,672 or 28·8 per cent., in 1883–84, being Rs. 26,726, or 2·3 per cent., less; *i.e.*, the more the available income, the less was the amount appropriated for sanitation. "Improvement of village sites" and "other sanitary objects" suffered chiefly by the reduction, while an improvement is observable in the allotments for the other items over the preceding year. Out of a sanctioned allotment of Rs. 3,72,946 for 1884–85, only Rs. 1,97,457 were expended, leaving Rs. 1,75,489, or a little less than half, to be spent in the concluding three months of the year. From past experience the whole of this amount would probably not be spent, but some money be left unutilized at the end of the year. In the year 1883–84, which represents the transactions for the entire period, we find that out of Rs. 3,99,672 only Rs. 3,08,288 were expended, leaving Rs. 91,384, or little less than one-fourth of the grant, unexpended. Under no one of the items was the sanctioned amount fully utilized. The same thing occurs year after year, and will most probably occur in 1884–85 also, notwithstanding the recent orders of Government and the Board of Revenue, which enjoined the complete utilization of the funds allotted for sanitation.

In some districts larger allotments have been made than in others. Eliminating the Nilgiris for obvious reasons, and Malabar and Canara, the conditions of which are such that no large outlay is devoted to conservancy, the rates varied from 10 per cent. in Coimbatore to 38 per cent. in South Arcot. In 7 districts there were between 25 and 36·7 per cent., and in 9 others between 15·9 and 22·5 per cent. Excepting in Coimbatore 10·0 per cent., Ganjam 15·9, Chingleput 17·3, Madura 18·0, and Godávari 19·2, the sanitary allotments of the other districts may be considered as fairly adequate, the only regret being that they were not always utilized to the full extent.

General Remarks.

As I did not take charge of the office till after the close of 1884, I have nothing to say under this head, but Surgeon-General M. C. Furnell, my predecessor in office, has furnished the following notes for insertion in the report:—

During the early part of the year the northern municipalities, Masulipatam, Guntur, Ellore, Rajahmundry, and Cocanada were visited by the Sanitary Commissioner, and those still further north, Berhampore, Chicacole, Vizianagram, Bimlipatam, Vizagapatam, and Anakápalle by the Deputy Sanitary Commissioner; besides these he also visited the municipalities in the districts of Cuddapah, Salem, Bellary, Anantapur, Kurnool, and Tinnevelley during the year. The difficulty of communication in the northern districts renders visiting them extremely difficult; and in some of the municipal towns and districts public bungalows have been done away with, so that an inspecting officer, ignorant of the fact, may arrive and find that he literally has no where to lay his head. Thus at the port of Masulipatam one is landed after a long and tedious sea passage of some four or five hours, in an open boat, from the steamer, on a hot and shelterless quay, and when one asks where is the public bungalow? is

informed there is none; and hotel? none. The municipal town of Masulipatam is some four or five miles further inland, and it is with the utmost difficulty, and after many hours waiting, one can obtain a common country bullock cart to get there. In Masulipatam town itself there is no bungalow, and one is literally obliged to proceed to the first house in *formâ pauperi* and ask for shelter. Some remedy for this state of things seems demanded; if local authorities cannot keep up public bungalows, the old state of things, when they were kept up by Government, might, with advantage to inspecting officers, be reverted to.

During the hot months cholera raged with great violence in the Tanjore collectorate and Government becoming uneasy repeatedly called attention to the fact; this induced Dr. Furnell to visit the district; his report is appended to the Sanitary Commissioner's Report for 1884.

In the months of November and December, North Arcot, Coimbatore, Trichinopoly and Malabar were visited by the Sanitary Commissioner. During the latter part of December and January and February 1885, Dr. Furnell acted as Surgeon-General during the absence of Surgeon-General Cornish on leave, and was therefore unable to tour.

ABSTRACT OF REPORT OF THE SANITARY COMMISSIONER FOR BOMBAY FOR 1884.

(Deputy-Surgeon-General T. G. Hewlett.)

General Population.

Vital Statistics.

On the 1st July 1884 the compilation of the Vital Statistics of the Presidency was for the first time entrusted solely to the Deputy Sanitary Commissioners. Up to this date the village returns had been compiled tálukvár by the mámlatdárs of each zilla, but this system had been found to be inefficient, and Government was pleased to sanction an establishment of compilers for the office of each Deputy Sanitary Commissioner who is thus brought each month into direct communication with every village in his district. Advantage was taken of this opportunity to re-arrange the Deccan and Konkan Registration Districts and to alter their designation, so that for the future the Northern Deccan, Southern Deccan, and Konkan Registration Districts will disappear from the Annual Return. The principle observed in fixing the areas of the new districts was to make them co-terminous with collectorates in which the same language is spoken.

The new arrangement has been found to work admirably as the statistics are now received from the villages with much greater punctuality than formerly. Government has been pleased to impress on Collectors the necessity for the village officers submitting their returns to the Deputy Sanitary Commissioner by a fixed date, and the Kulkarnis and Talátis are liable to a fine if any complaint is made regarding the late submission of the returns when due.

In the Presidency of Bombay, including Sind, during the year 1884 the births of 278,986 males and 255,737 females, or a total of 534,723 children, were recorded, against 261,966 boys and 239,835 girls, or a total of 501,801 children in 1883. The recorded births for 1884 are thus 32,922 in excess of those for the previous year, whilst they exceed the mean of the preceding 10 years ending 1883 by 166,165.

The following table shows the number of births registered in each year from 1874 to 1884, their ratios per 1,000 of population and the proportion of males to females:—

Years.	Number of Births Registered.			Rates per 1,000 of Population.			In every 100 Births there were		For every 100 Male Births the Females were
	Males.	Females.	Children.	Males.	Females.	Children.	Males.	Females.	
1874	174,966	157,842	332,808	10·81	9·75	20·56	52·57	47·43	90·21
1875	178,332	161,937	340,269	11·05	10·01	21·06	52·49	47·51	90·82
1876	181,972	165,512	347,484	11·24	10·21	21·45	52·64	47·36	89·95
1877	164,263	147,399	311,661	10·15	9·11	19·26	52·75	47·25	89·73
1878	128,848	114,405	243,253	7·96	7·07	15·03	52·97	47·03	88·78
1879	151,460	136,410	287,870	9·38	8·41	17·74	52·61	47·39	90·06
1880	196,285	174,588	370,873	12·08	10·82	22·85	52·66	47·34	89·91
1881	239,912	219,745	459,657	14·58	13·35	27·93	52·19	47·81	91·59
1882	255,927	235,419	491,346	15·55	14·31	29·86	52·09	47·91	91·98
1883	261,966	239,835	501,801	15·92	14·58	30·50	52·20	47·80	91·55
Mean for 10 years	193,839	175,219	369,558	11·86	10·75	22·61	52·46	47·54	90·63
1884	278,986	255,737	534,723	16·96	15·54	32·50	52·17	47·83	91·67

It is satisfactory to notice the progressive improvement that, except in the three years of famine, has taken place in the registration of births.

The number of births in 1884 was higher in each of the districts than that recorded in the previous year. The total increase for the Presidency was 9·89 per 1,000 of population above the mean of the preceding 10 years.

It is most disappointing to have to bring again prominently to the notice of Government the extremely defective state of the registration of births in the City of Bombay which, as will be seen from the following statement, has steadily decreased year by year.

In 1880 the births amounted to		16,997 or 26·38 per	1,000 of population.
„ 1881	do.	16,381 or 21·19	do.
„ 1882	do.	15,094 or 19·52	do.
„ 1883	do.	14,932 or 19·31	do.
„ 1884	do.	14,377 or 18·59	do.

Bombay instead of setting an example as the leading municipality, occupies a very low place in the list of towns as regards the registration of births, and it is evident that very many births escape registration. I trust that Government will be pleased to invite the especial attention of the Municipal Commissioner to this fact and urge him to take measures so as to secure a much more correct registration.

The recorded birth-rates among the urban and rural populations of the Presidency were respectively 25·53 and 33·52, against 25·07 and 31·29 in 1883. The birth-rates recorded among the rural population of each collectorate except Ratnágiri, Kánara, Ahmedabad, Karáchi and Hyderabad were higher than the birth-rates registered in the urban circles. The same fact regarding the above collectorates was also observed in 1883.

Out of the 55 towns in the Presidency only 12 had a birth-rate exceeding 40 per 1,000 which may be taken as the lowest rate which can be accepted as even approximately correct, although as I shall presently show there are grounds for believing that the birth-rate is in reality higher than this. It seems as if this important subject was entirely neglected in some of our largest municipalities, and especially at places which are the head-quarter stations of the collectorates. This is inexcusable, and it is lamentable to find that for example in the City of Poona a birth-rate of only 15·88 is recorded. I would earnestly hope that Government may be pleased to invite the especial attention of the authorities in each town to the very defective character of the registration of births and to impress on them the absolute necessity of much greater attention being paid to this most important subject.

In 1884 among the civil population in the Town, Rural and Cantonment circles of the Presidency of Bombay the deaths of 214,376 males and 194,033 females, or a total of 408,409 persons, were recorded. In the previous year 420,198 deaths or 11,789 more than in 1884 were registered. The following statement shows the number of deaths registered in each year since 1874 :—

1874	-	278,652	1878	-	532,951	1882	-	343,418
1875	-	375,718	1879	-	387,542	1883	-	420,198
1876	-	368,260	1880	-	328,673	1884	-	408,409
1877	-	627,708	1881	-	381,450			

Excluding the famine years 1877–78, the recorded deaths in 1883 and 1884 were more numerous than in any of the series.

The computed death-rate per 1,000 of population in 1884 was 24·62, against 25·53 in 1883, and exactly the same as the decennial mean. Omitting Sind, where the mortuary registration is extremely defective, the recorded death-rate in the other parts of the Presidency amounted to 26·12 per 1,000 of the population.

The millesimal ratio of males dying to males living was 25·23, and of females dying to females living 24·39. In 1883 these ratios were respectively 26·02 and 25·02. For every 100 females who died 110·48 deaths among males were registered, but these proportions varied considerably in some of the districts.

The mortality amongst infants under one year and children above one year but under five was, as usual, terribly high, in comparison with other periods of life. In fact, the deaths in children under five years of age formed 45·07 per cent. of the total deaths. The extremely high rate of mortality among children of tender years affords unmistakeable proof of local causes of insanitation throughout the Presidency. The period of greatest immunity was in the ages above 10 and under 15, the rate being 6·37 per 1,000. For those "above 60 and upwards" the mortality was at the rate of 58·63 per 1,000. The per-centage on total deaths amongst infants under one year was 23·79, against 21·35 in 1883. For those above one and under five the per-centage on total deaths was 21·28, against 19·19 in 1883. For old people above 60 and upwards the per-centage on total deaths was 10·66, against 10·38 in 1883.

The subjoined table shows the deaths in 1884, arranged according to the specified causes laid down by the Government of India and contrasted with the results for 1883

and the mean of the preceding 10 years. The causes of deaths will be more particularly noticed in the next section :—

Deaths by Causes.	Mean of 10 Years, 1874-83.		1883.		1884.	
	Number.	Ratio per 1,000 of Population.	Number.	Ratio per 1,000 of Population.	Number.	Ratio per 1,000 of Population.
Cholera	25,888	1·56	37,954	2·31	13,804	0·84
Small-pox	6,869	0·42	13,404	0·81	14,438	0·88
Fevers	263,385	16·16	266,741	16·21	276,989	16·83
Bowel complaints	34,053	2·09	35,292	2·14	35,983	2·19
Injuries	6,443	0·40	5,978	0·36	5,570	0·34
Other causes	68,819	4·19	60,829	3·70	61,625	3·74
All causes	404,457	24·82	420,498	25·53	408,409	24·82

Cholera.

During 1884 cholera caused 13,804 deaths throughout the Presidency, or 24,150 less than in the preceding year. The epidemic was most severely felt in the Southern Registration District, as 8,534 of the total deaths were recorded in it, of which 4,655 took place in the Dhárwár collectorate. Thar and Párkar collectorate alone in the Sind District enjoyed perfect immunity from cholera, all the other collectorates in the Presidency having been affected more or less during the year under report.

The total number of deaths from cholera in each of the 19 years ending with 1884 were as follows :—

1866	28,027	1873	283	1879	6,937
1867	5,143	1874	37	1880	684
1868	6,347	1875	47,555	1881	16,694
1869	52,330	1876	32,117	1882	7,904
1870	2,666	1877	57,253	1883	37,954
1871	5,821	1878	46,743	1884	13,804
1872	15,642				

so that the number of cholera deaths in 1884 was 24,150 less than in 1883, and 11,585 below the decennial mean; and was exceeded in 9 out of the 19 years above quoted.

I have shown the statistics of Sind separately, as its physical condition and therefore its epidemiological history differs from the rest of the Presidency. For example, in 1874, 1877, 1880, and 1881, or four years out of the 10 included in the form, there was no cholera at all in Sind; and in 1875, with the exception of 42 deaths in the Karáchi collectorate and six in Thar and Párkar, the remaining collectorates were free. In 1876 there were 88 deaths in the Thar and Párkar collectorate, but none in the other parts of the province. In 1878 there were 26 deaths in the Thar and Párkar collectorate, whilst the rest of Sind enjoyed complete immunity. In 1879 the disease was present throughout the district, but for the next two years there was no cholera in Sind, and in 1882 only three deaths occurred in Thar and Párkar.

The immunity from cholera which Sind, as a general rule, enjoys, is of deep epidemiological interest, and I attribute it to a great degree to its extremely dry climate and the very light rainfall. It has only appeared in two years of the series in the Karáchi collectorate, 1875 and 1879. In 1875 it appeared in November but died out in December. In 1879 it commenced in May, attained its maximum in June, and died out completely in September. In Hyderabad collectorate, during the 10 years, it was only present in 1879. The disease commenced in May, attained its maximum in June and died out in July. Thar and Párkar collectorate has suffered more severely than the rest of Sind, as the disease was present in five out of the 10 years. In 1875, five deaths were reported in June and one in July. The next year it began in May, continued in June and July, but died out in August. In 1877 there was no cholera, but in 1878 there were seven deaths in March and 19 in April when it ceased. In 1879 there were eight deaths in May and 66 in June, but no more during the year, and since then with the exception of three deaths in May 1882, there was no more cholera in Thar and Párkar. In the Shikárpur collectorate cholera was

only present in one year, 1879, out of the 10 years. It commenced in May, attained its maximum intensity in June, but died out in November. In the Upper Sind Frontier also the disease only appeared in 1879. It commenced in May, attained its maximum in June, and died out in July, since which time it has been free. The disease broke out in the Shikárpur collectorate on the 2nd October 1884; on the 14th it appeared in the Upper Sind Frontier collectorate, on the 15th in the Karáchi collectorate, and on the 19th in the Hyderabad collectorate. Thar and Párkar escaped. In the Upper Sind Frontier collectorate the disease ceased in November, and at the close of the year it had nearly disappeared from Shikárpur and Hyderabad, but still prevailed in the Karáchi collectorate.

In the Presidency out of 13,804 cholera deaths registered during the year 7,448 occurred among males and 6,356 among females; so for every 100 deaths among males there were 85 deaths among females. The ratio per 1,000 of males dying to males living was 0·88, and of females dying to females living 0·80. Last year they were 2·34 and 2·27 respectively. The deaths among females exceeded those among males slightly in the Khándesh, Ahmednagar, Poona, Sholápur, Ratnágiri and Kaládgi collectorates; whilst in the remaining 17 affected zillas the reverse was the case.

Out of 283 Registration circles into which the Presidency is divided for registration purposes (221 rural, 55 town and seven cantonment circles) 157, namely, 124 rural, 31 town, and two cantonment circles were affected with cholera. The total cholera mortality was distributed over 1,450 registration units, *viz.*, 31 towns, two cantonments, and 1,417 villages. Out of the entire population (16,454,414) of the Presidency 4,629,175 persons or 28·13 per cent. were living in the affected localities. Of these 13,804 or 3 per 1,000 died. Out of 24,536 inhabited villages in the Presidency, 1,427 or only 5·78 per cent. were affected with cholera.

As before noticed, during the year, out of the 24,536 villages in the Presidency 1,417 or 5·78 per cent. were affected by cholera. In the Dhárwár collectorate there are 1,231 villages, of which 421 or 33·19 per cent. were affected. In Belgaum out of 1,073 villages 207 or 19·29 per cent. were attacked, whilst in the Kaládgi collectorate there were 160 out of 1,140 villages or 14·03 per cent. affected. In the Karáchi, Broach, Shikárpur, Thána and Kaira collectorates the affected villages were 96, 78, 68, 64 and 57 respectively; whilst in the remaining 14 affected collectorates they were below 50.

Small-pox.

During 1884 the deaths from small-pox of 7,327 males and 7,111 females, or a total of 14,438 persons, were recorded against 13,464 in 1883, and a decennial mean of 6,869. Small-pox prevailed in an epidemic form in three districts. It was most severe in the Southern registration district, where the ratio per 1,000 of population was the very high one, 2·90 against 0·61 in 1883, and a decennial mean of 0·38. In the Central registration district there was a ratio of 0·72 against 0·70 in the previous year and 0·32 the decennial mean, and in the Sind registration district the ratio was 0·43 per 1,000 of population against 0·33 in 1883 and 0·15 the mean of the previous ten years. In the Western registration district and in the Eastern Gujarát registration district there was a decrease during the year, their respective ratios being 0·39 against 1·54 and 0·77 in the former, and 0·19 against 0·56 and 0·38 in the latter.

According to age 25·8 per cent. of the deaths occurred among infants under one year of age, whilst 37·6 per cent. took place among children over 1 (one) and under 12, the remaining 36·6 per cent. being among persons over that age.

In December 1883, 1,033 deaths were registered throughout the Presidency, and in January (1884) the number rose to 1335, and reached its maximum intensity 2,413 in March. The disease then commenced to decline, and the minimum was registered in October; but the setting in of the cold weather, as usual, appears to favour the development of the poison, as the deaths from small-pox rose in December to 309 or 109 above the number recorded in the month of October.

Fevers.

During 1884, 144,596 males and 132,393 females, or a total of 276,989 persons, were reported to have died from fever. The increase therefore for the year under report as compared with 1883 amounted to 10,248 deaths, the mean for the previous 10 years being 263,385.

In all the districts excepting the western fever has caused higher mortality during the year than in 1883. In the Eastern Gujarát registration district the fever death-rate was the high one of 22·72 per 1,000 of population against 20·04 in 1883 and 20·01 during the previous 10 years. In the Central registration district the ratio was 16·46 against 15·69 in 1883 and 15·12, the decennial mean. In the Western registration district the ratio, 16·19, was nearly as high as in the Central registration district, but

it was lower than the previous year, 18·61, though higher than the decennial mean, 15·88. The ratios in the Southern and Sind registration districts were exactly the same, 14·47, during the year, and both were higher than in 1883, but in the Southern registration district it was lower than the decennial mean, 17·89.

The death-rate from fever in the urban zillas of the Presidency amounted to 13·83 per 1,000 of population against 12·44 in the previous year, but among the rural population it amounted to 17·27 against 16·76 in 1883. This fact was pointed out in my report for 1883 as proving the necessity for improving village sanitation.

The highest death-rate from fever is reported to have occurred at Viramgám, a town in the Ahmedabad collectorate, where it attained the enormously high rate of 42·60 per 1,000 of population against a zilla rate of 22·98. In only 14 towns situated in 8 different collectorates, excluding the City of Bombay, the death-rate from fever is higher than the average death-rate of the zilla. In the Sholápur collectorate there are three towns, viz., Sholápur, Bársi and Pandharpur, and in all, the town rate is higher than in the collectorate. In the town of Ratnágiri the death-rate from fever is higher than that of the zilla. In Kaira collectorate, with the exception of Borsad, the town rate is higher than the average death-rate of the zilla. In the Ahmedabad collectorate in the towns of Ahmedabad and Viramgám the rate is much higher than the average district rate. In Hyderabad the rate is higher by 1·72 than the zilla rate. In Umarkot it is nearly double that of the zilla rate. In the two towns of the Shikárpur collectorate, viz., Shikárpur and Lárkhána, the rate is higher than the zilla rate, so also Jacobabad has a higher rate than that of the collectorate. The attention of the municipal authorities is invited to the above fact, and they should lose no time in investigating the local causes of the high mortality from fever within their municipal limits.

Bowel complaints.

During 1884, bowel complaints caused the deaths of 19,953 males and of 16,030 females, or a total of 35,983 persons against 35,292 in 1883 and a decennial mean of 34,053. By districts the Southern registration district headed the list with the very high ratio of 4·20 per 1,000 of population against 3·48 in 1883 and 3·40, the decennial mean. Gujarát comes next with a ratio of 2·71, and next to it is the Western registration district, 2·09, and following it is the Central registration district, 1·84, and the last of all is Sind with a rate of 0·26 per 1,000. In the Presidency the rate was 2·19 against 2·14 in the previous year, and a decennial mean of 2·09. The last three districts show a slight increase in the death ratios, whilst in the first two there was a slight decrease.

Injuries.

During 1884, 3,231 males and 2,339 females, or a total of 5,570 persons, met with violent deaths. The mortality from these causes is less by 408 than in 1883 when 5,978 deaths were recorded. Of the 5,570 deaths 2,461 were caused by drowning, 1,077 resulted from snake-bites, 415 from wounds, 213 by hanging, 121 by poisoning, 118 from attacks by wild beasts, and 1,165 from causes not specified.

Other causes.

The recorded deaths from causes other than those specified numbered 61,625, 31,821 of which occurred among males, and 29,804 among females. The total for 1883 was 60,829, so for this year there is an increase of 796.

Vaccination.

The following table contrasts the work amongst the civil and military population during the year under report with that for 1883–84 :—

Establishment.	Persons primarily vaccinated.				Persons re-vaccinated.				Total Number of Persons operated on.			
	1884-85.	1883-84.	Increase.	Decrease.	1884-85.	1883-84.	Increase.	Decrease.	1884-85.	1883-84.	Increase.	Decrease.
In Civil Life.												
Itinerant	774,511	792,784	—	18,473 2·33	50,990	50,494	9,505 18·82	—	824,310	843,278	—	18,968 2·25
Dispensary	24,014	29,986	—	5,972 19·92	1,780	2,525	—	745 29·50	25,794	32,511	—	6,717 20·66
Total	798,525	822,770	—	24,445 2·97	51,770	53,019	9,505 17·93	745 1·41	850,104	875,789	—	25,685 2·93
In Army Life.												
Native Army	3,554	3,698	—	144 3·89	1,435	2,846	—	1,411 49·58	4,989	6,544	—	1,555 23·76
British Army	328	497	—	169 34·00	147	1,009	—	862 85·43	475	1,506	—	1,031 68·46
Total	3,882	4,195	—	313 7·46	1,582	3,855	—	2,273 58·96	5,464	8,050	—	2,586 32·12
Total for the whole Presidency.	802,207	826,965	—	24,758 2·99	53,361	56,874	9,505 16·71	3,018 5·31	855,568	883,839	—	28,271 3·07

Eight hu[illegible] vaccinated a[illegible] showing a net [illegible] net increase of 6,[illegible] able decrease (68·[illegible] figures being 475 a[illegible] re-vaccinations was 5·31 [illegible] being 85·43 per cent. On the [illegible] words, for every hundred person[illegible] have been 97·93.

Out of 802,207 persons primarily vaccinated [illegible] 95·29 per cent., being 0·40 per cent. below 1883–8[illegible] cases was in excess of that in the preceding year, being [illegible] thousand eight hundred and sixty-eight persons were ope[illegible] account of the failure of the first operation, and in 21,[illegible] unknown. During the year 63,361 persons were re-vaccin[illegible] 1883–84. In 64 instances the re-vaccinations were repeated [illegible] result could not be ascertained, and in 14,406 the operations [illegible] successful cases was 41,255, or 65·11 per cent., against 66·21 [illegible] The total number of persons operated on was 865,568, and of t[illegible] per cent., were successful. In 1883–84 the per-centage was 93·79, [illegible] operated on more than once; the "unsuccessful" numbered 33,014 a[illegible] cases were 29,786.

In primary vaccinations the per-centages are higher than in the [illegible] Government, municipal, and cantonment establishments, and in th[illegible] The highest per-centage is 99·12 in cantonments and the lowest is 87·[illegible] Army. The next highest is 96·63 in Government and the next low[illegible] dispensaries. In re-vaccinations the lowest per-centage is 55·99 in ca[illegible] the highest is 89·68 under Government.

The age details are compiled for three periods, viz., under one year, betw[illegible] six, and above six years. The numbers under each period primarily vacc[illegible] respectively 525,905, 257,938, and 18,364, against 504,282, 298,582, and 24,1[illegible] the preceding year. At the rate of 31 per 1,000 of population, and on t[illegible] population of 25,615,528 there were successfully vaccinated 63·41 per cent., against [illegible] in 1883–84, 59·01 in 1882–83, 58·35 in 1881–82, 49·27 in 1880–81, and 39·78 in 187[illegible] Thus each year is characterised by progress in the protection afforded to infants.

Animal vaccination was carried on in Bombay, Poona city and cantonment, Broach and Kaira collectorates and Jámnagar. The operation of inoculating heifers was generally successful. In Western Gujarát animal vaccination was, before the cold weather tour, carried on in Jámnagar by the Assistant Superintendent of Vaccination, who successfully inoculated nine heifers and distributed the lymph among the vaccinators. Except in Bombay, where animal lymph only is used, and in Poona, Broach, Ankleshvar, Nadiád, Borsad, A'nand and Jámnagar, where both animal and human lymph were in use, vaccination in all other places was carried on from arm to arm and with human lymph. Vaccination with animal lymph was also carried on in Bandora.

Taking together the work of all the Deputy Sanitary Commissioners, Superintendents of Vaccination, Assistant Superintendents of Vaccination, and Inspectors of Sanitation and Vaccination, there were 4,546 encampments, 87,076½ miles travelled in 8,063 days, and 332,759 children inspected in 12,709 villages. Out of every 100 persons operated 38·44 were this year inspected, against 40·76 in the preceding year.

In Bombay the Compulsory Vaccination Act has been in force for seven years, and in Karáchi for five years, and in both places there has been, since the introduction of the Act, a considerable increase in the number of infants protected.

Sanitary Works.

The actual outlay on sanitary works (Military) during 1884 amounted to Rs. 98,885. Military Works.
Of this sum Rs. 34,948 were expended at Ahmedabad, of which Rs. 34,591 were for constructing hospital for British troops. At Deesa Rs. 4,751 were spent, of which Rs. 2,866 were for constructing latrines for Native infantry, and Rs. 1,035 for erecting contagious disease ward to the Native Cavalry Hospital. At Nasirabad Rs. 22,627 were expended, of which Rs. 14,382 were for constructing a new circular storage tank and filter-bed in connexion with the water-supply scheme. At Indore Rs. 2,062 were expended on a new pucca well for the Native infantry lines. At Hyderabad Rs. 6,477 were spent, of which Rs. 5,815 were for improving the drainage of military buildings.

[redacted] the upper
[redacted] from the iron
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[redacted] ven in the Sanitary
[redacted] palities during the year
[redacted] conservancy by them was.

[redacted] ceedings and General Remarks.

[redacted] e year I was on tour in the Ahmednagar districts, and
[redacted] ern tálukas of the Poona collectorate on my way to Pand-
[redacted] a, after visiting which I proceeded *viâ* Sángola and Dufflápur
collectorate, where I inspected four municipal towns and
[redacted] hápur and Sátára. In April I went to Ahmedabad to report on
[redacted] ikwár's Haveli for a central jail, and on my return to Bombay
company with the Inspector General of Prisons to select a site
passed May at Mahábleshvar and spent the rains at Poona, but
[redacted] ay in September to meet the English Cholera Commissioners In
[redacted] to Ahmedabad, and with the Inspector General of Prisons selected
[redacted] jail. On my return to Poona I visited Ahmednagar, but received
[redacted] ernment to report on the sanitary condition of the mills and factories
[redacted] hich work I was engaged until nearly the close of the year.

[redacted] ore important events of the year I must notice the appointment of a
[redacted] Officer of the Port, which was sanctioned in Government Resolution,
[redacted] tment, No. 1,979, dated 10th June 1884. The Government of India
[redacted] e officer nominated to the post should belong to the Bombay Medical
[redacted] placed under the orders of the Sanitary Commissioner. Surgeon
[redacted] D., was accordingly appointed and took charge of his duties on the
[redacted] Government was pleased to allow him a clerk, two peons, and to permit
[redacted] to be constructed for his use.

[redacted] o record as likely to exert a most important influence on the sanitary
[redacted] the Presidency the appointment of a consulting sanitary engineer for the
[redacted] of Bombay. As far back as 1876 I had, whilst acting as Sanitary Com-
[redacted] represented to Government the great need of such an officer, and in July I
brought the subject again forward, for as head of the Sanitary Department I was constantly feeling that I was called upon to report on schemes which demanded the knowledge of an expert. Moreover, however tardily, sanitary measures are engaging the attention of municipalities throughout the Presidency, and I am very desirous that, especially as regards structural works of sewerage and drainage, no mistakes should be made, for if they are, discredit will be brought upon the water carriage system and pipe sewers, which would be a great discouragement to those interested in sanitary reform in India.

It is not reasonable to suppose that every district engineer, however able and efficient he may be in his own branch of engineering, is qualified to undertake the design of especial sanitary works. Sanitary engineering is as much a speciality and as distinct a branch of engineering as obstetric or opthalmic surgery are in curative medicine or surgery.

Engineers too in India have hitherto had no opportunity of studying or practising sanitary engineering on a large scale, and consequently are not, as a rule, qualified to deal satisfactorily with the subject. Mistakes which I can only term hideous have been made in past years. I need only refer for example to the arrangements originally designed and carried out for the disposal of nightsoil and bathing water from Government House, Ganesh Khind, to show the necessity of having some officer to refer to who has made sanitary engineering his special study. I accordingly submitted to Government the name of Lieutenant-Colonel Ducat, R.E., as an officer who had specially studied the subject in England and whose report on the drainage of Poona had received the highest commendation from Sir Robert Rawlinson.

Government in sanctioning my proposal was pleased to say that my suggestion was only reasonable and proper, and pointed out that when the Sanitary Commission for Bombay was first formed in 1864 it consisted of a president, three members and a secretary. One of the members was an engineer who in addition to his other duties acted as professional adviser to the president, and on that account received a special allowance of Rs. 300 per mensem.

His Excellency the Governor in Council proposed with the sanction of the Government of India to inform municipalities that Government will be prepared to place at their disposal the services of Lieutenant-Colonel Ducat, an officer specially qualified to advise in such matters on the municipality paying, during the period for which he is employed, his salary with the prescribed contribution on account of his pension and leave allowances and such deputation allowance not exceeding Rs. 10 per day, as Government may see fit to fix.

The Government of India was pleased to sanction the above proposal, and Government in its Resolution, General Department, No. 3,952, dated 30th October, appointed Colonel Ducat Consulting Sanitary Engineer for the Presidency of Bombay.

I have already derived the greatest assistance from Colonel Ducat. Plans for the drainage of the new buildings at Elphinstone College, at the European General Hospital, and in the Marine lines have been submitted to him and he has corrected mistakes in them.

I am also very glad to be able to record that the Municipalities of Ahmedabad and Hyderabad in Scind have applied to Government for his services. The former in connection with water-supply and sewerage, and the latter city, which has a good water-supply, for a sewerage scheme.

I am confident that as time goes on other municipalities will follow this good example. Ahmednagar and Surat require structural works to make them healthy, and I would hope that Government will, under the power reserved to itself in the District Municipal Act, insist on Násik and Pandharpur, which are the two places principally visited by pilgrims in the Bombay Presidency, providing themselves with a pure water-supply and a good sewerage scheme.

The report submitted by the Factory Commission during the year must be noticed as embodying measures which, if sanctioned by the Government of India, cannot fail to exercise a very beneficial effect on the health of the large number of persons employed in the mills, &c., throughout the Presidency, and especially in the city of Bombay.

These measures contemplate improvements being effected in the construction of all new mills which it is recommended should only be permitted to be erected according to a standard plan. They provide means for improving the ventilation and for ensuring the effectual removal of impurities suspended in the air as well as for the maintenance of cleanliness.

The Commission recommended that the age at which children should be employed should be raised from seven (as at present) to nine years, and that children should not work for more than nine hours out of the 24, and that all persons under the age of 14 should be considered children.

Women and children employed in factories should be granted four days holidays in each month, and no child should be employed in a factory unless he or she can produce a certificate signed by a certifying surgeon to the effect that the applicant is of the prescribed age and is physically fit.

In the City of Bombay the most important sanitary measure has been the resolution passed by the corporation to undertake the construction of the Tánsa Reservoir, which, on its completion, will ensure the city from the periodical want of water it now occasionally suffers, and will provide the surest means for the safe introduction of water-closets throughout the town. During the year the nightsoil has been sent out through the main sewer to Love Grove, whence it is pumped into the sea. The harbour at Carnac Bandar, therefore, is no longer defiled by the accumulated nightsoil of Bombay.

I must also mention that owing to the philanthropic exertions of the Roman Catholic bishop a house in Trombay has been obtained which is in process of conversion into a leper asylum, which will be of the greatest service in affording proper shelter for the unfortunate lepers in Bombay.

Credit is due to the Deputy Sanitary Commissioners for the zealous manner in which they have conducted their duties during the year. A very great amount of additional work was imposed on them in connexion with the compilation of vital statistics, and to their careful superintendence the success which has attended the introduction of the new system is very largely owing. At the same time I must cordially acknowledge the valuable assistance afforded by the collector and district officers in each zilla by their bringing whenever required pressure to bear on the village officers so as to ensure the punctual submission of the registers of births and deaths when due.

ABSTRACT OF THE REPORT OF THE CALCUTTA MUNICIPALITY FOR 1884-85.

(*Mr. H. L. Harrison.*)

For a comprehensive view of the town improvements effected in Calcutta during the past few years, the report of 1882–83 should be read which carries the narrative up to the end of that year. In the present report the work done during the year will be briefly stated under each of the eight heads there enumerated, viz. :—

(1.) Water supply, both filtered and unfiltered.
(2.) Sewerage.
(3.) Improvement of privies and latrines.
(4.) Structural improvement of bustees.
(5.) Obliteration of tanks and wells and provision of water in lieu thereof by means of bathing platforms.
(6.) Surface conservancy and surface drainage of bustees.
(7.) Measures for improving cowsheds and cattlesheds in the town.
(8.) Structural improvements in the streets of the town.

Water supply.

(1.) *Filtered supply.*—In the report for 1882–83 the figures were given showing that by better attention to filters, and by economising in every way, the daily supply of filtered water had risen from 6,500,000 gallons daily, originally provided, to 7,400,000 gallons, and then to 7,825,000 gallons daily throughout 1882, and to 8,050,000 in the first quarter of 1883. This supply has since been fully kept up. During the three hot months of 1883–84 an average of 8,278,000 gallons was conveyed into the town, and taking the 12 months as a whole, the daily average amounted to 7,976,000 gallons; in 1884–85 the supply for the three hottest months was 8,317,415, and for the whole 12 months 8,207,330.

The most important extension work is the new 48-inch main, which has to be laid between Pultah and Tallah. A contract for this was entered into with Messrs. Cochrane Grove and Co. on the 2nd October 1883 and towards the end of the rains of 1884 the pipes began to arrive. No time was lost in commencing to lay them as soon as the cessation of the rains made the ground favourable for such operations. The services of two skilled pipe-layers were obtained from England, and by the end of April 2,255 out of 5,720 pipes (the total number to be laid) had been laid, and by the end of June the number had increased to 3,249.

Due steps have been taken to push on with the subsidiary works. The necessary land has been acquired at Pultah for the new filters and settling tanks. The additional engines and machinery requisite for the Tallah and Wellington Square pumping stations have been ordered from Messrs. James Watts and Co., and tenders obtained for the new engines at Pultah. Besides this, the Commissioners have decided on erecting a new pumping station for the west of the town on certain land belonging partly to them and partly to Government in Halliday Street, and have obtained Government sanction to the project. They are, however, very much hampered in pushing on with the works by the want of funds. The Calcutta money market has been most unfavourable. The Government of India in April 1884 advanced the Corporation five lacs, and has allowed the loan to be retained without interest up to the 31st July next, and in October, when the Calcutta market was for a few weeks more easy, the Commissioners succeeded in obtaining 15 lacs at 5 per cent.; but soon afterwards money again became scarce to an almost unprecedented extent, and the obtaining a further loan was out of the question. In the face of these difficulties the Commissioners, who had already entered into contract for the 48-inch main and the Tallah machinery, did not feel justified in assuming any fresh responsibilities until they saw their way to obtaining the funds necessary to meet them. They have therefore advertised a loan for 25 lacs in July, and are waiting the result before entering into further contracts. An application to Government to finance them temporarily in the

event of their pushing on with the works, and not being able to obtain the money in the local market, has not been acceded to.

Extension of unfiltered water supply.—The new pumping station at Mullick's Ghat was completed before the beginning of the year under report, but it could not be used because the attempt to sink a well in the river bank, and thus connect the suction-pipe with the river, proved a failure. A jetty had therefore to be constructed, and after much delay the station began working on the 28th February. It soon appeared, however, that its pumping power could not be adequately utilised until the pipe system had been enlarged. The engines could pump 400,000 gallons an hour, but the pipes at a safe pressure could not carry more than 250,000; and it is precisely in the conveyance of a full supply during certain hours of the day, when unfiltered water is simultaneously needed for road watering, latrines and night-soil depôts and bathing platforms, that the advantage of the more powerful engines would be most appreciated. Larger pipes had therefore to be substituted, and the work of changing them was still going on at the close of the year.

(2.) *Sewerage.*—The sewerage of the town, with the exception of Hastings and Baug Bazar, has nearly been completed; operations are now limited to supplementary work designed to complete the system where it was left imperfect. The expenditure during the year was 1,20,698. The Hastings project was at last carried at a meeting of the Commissioners held on the 7th February 1885; the opposition of the inhabitants having been overcome, it has been taken in hand during the present year. The Baug Bazar project is partly approved of, but the engineer is still unable to see his way to overcoming certain difficulties. The survey of the suburban area lying between Circular Road and the Canal has been completed, and a scheme is under preparation which will necessitate the sanction of Government under section 168 of the Act. Drainage.

(3.) *Improvement of Privies, Latrines, &c.*—As regards the reconstruction of privies, the progress made during the year was very good, though not equal to the high-pressure rate of the two preceding years. The figures are—new privies sanctioned according to improved plan:—

Year.	No.	Year.	No.
1878 - - -	744	1882–83, 15 months - -	2,836
1879 - - -	435	1883–84 - - -	2,271
1880 - - -	890	1884–85 - - -	1,786
1881 - - -	1,333		

The attention of the Health Department has been specially directed to surface drainage during the year, so as to carry off washings, and the amount of work done in this direction has been much above the average.

(4.) *Structural Improvement and Subsoil Drainage of Bustees.*—So far as the expenditure is a guide, this work has been pushed on during the year with considerable energy. There was no relaxation of effort, and the impetus given to the work in 1882–83 was fully sustained.

(5.) *Obliteration of Foul Tanks and Wells, and substitution of Bathing Platforms.*— Tank-filling has been pressed on with energy during the year, and 29 tanks have been filled up by the Corporation in addition to four filled up by the owners during the year. A new policy has been formally adopted during the year, viz., wherever possible, to purchase the tank, and either convert it into a square, or utilise it for cowsheds, bathing platforms, or washing reservoirs. The site of a filled-up tank in Komedan Bagan has been converted into a square, the adjacent portion not needed for the square being sold. A tank at Tollolah belonging to Maharajah Sir Joteendro Mohun Tagore, K.C.S.I., which was filled up by the Corporation, has been given up by him to the Corporation to form into a square, on condition of further land being acquired to enlarge it, and the square being called after his father. The ground covered by two tanks filled up in Jorapukur bustee has been acquired for construction of model cowsheds and washing reservoirs. Other similar projects are under consideration. Tank filling.

The usual opposition which tank filling with refuse evokes culminated in a prosecution for thus filling up a tank in Komedan Bagan in the proximity of the new square. In the present instance the case was energetically defended, and medical evidence in favour of the practice cited, and the magistrate, after visiting the site, dismissed the complaint.

Wells.

Although the law gives the Corporation no power to close wells, yet all that was possible was done during the year to fill up as many of the most insanitary wells as could be filled up. The Health Officer prepared a list of the worst and most dangerous wells in the town, and 68 were closed by his Department during the year. It will be seen that he expresses a hope that, when the filtered supply is extended, the law may be changed, so as to allow the closure of all the wells in the town.

Bathing platforms.

It was mentioned in last year's report that the construction of bathing platforms had been sanctioned; these had been completed before the close of the year, and the construction of 17 more was only delayed by the difficulty in obtaining the land. The work has been pushed on steadily during the year, and by the end of it 28 were in working order. It admits of no dispute that they have proved a very great boon to the lower classes, even though the water they distribute is only unfiltered water, and numerous applications are now received for their construction in all parts of the town. The water during certain hours of the day is taken off faster than it can be supplied through a large tap, and the reservoir is in consequence all but empty. The multiplication of bathing platforms is somewhat retarded by the insufficient size of the unfiltered distribution pipes already referred to. The consumption of water takes off the pressure from the road watering, and it is necessary to await the enlargement of the pipes before constructing more platforms. Good progress is, however, being made with this; and meanwhile the Bustee Committee have sanctioned the erection of 25 more, two on sites belonging to the Corporation and 23 on sites to be acquired, and it is intended to raise the number in working to 60 by the end of the current year. Besides the large reservoirs for bathing in the newer designs, two smaller reservoirs are attached for washing clothes and cooking utensils. Separate platforms are also constructed for males and females.

Conservancy.

(6.) *Surface Conservancy of Bustees.*—It was reported last year that the Commissioners had sanctioned a special conservancy establishment for the purpose of cleaning bustees and keeping the surface drains in order. This consisted of—

	Rs.
2 Inspectors on	120 to 180
2 Sircars on	14
12 Peons on	7
200 Dhangurs on	5-8
and 32 hired carts,	

and it was computed that out of 207 bustees, with an area of 2,222 bigahs, 72 of the largest, with an area of 1,270 bigahs, had been taken up, cleaned and placed under routine arrangements by the end of 1883–84. During the year under report, the remaining areas have been similarly dealt with, and the whole is now under permanent arrangement. It has been found necessary, however, to increase the staff to 18 peons, 300 dhangurs, and 75 hired carts, which, by the amalgamation of the Bustee and Nuisance Departments effected in December last, are now placed under four inspectors, who divide the town into four portions, each looking after the nuisance and bustee conservancy of his section.

At first only Rs. 80,000 were sanctioned as the Bustee grant for 1884–85, under the impression that, as only Rs. 55,000 had been spent in 1883–84, more would not be needed in 1884–85. It soon, however, became apparent that this was an error; the reason why so little had been spent in 1883–84 was because so much of the expenditure which had really been incurred had not been brought to account before the 31st March, and would therefore swell the expenditure in 1884–85. A further sum of Rs. 53,140, equal to the estimated amount thus anticipated, was added to the grant, and, later on, a further grant of Rs. 10,000 was made. This raised the total grant for the year to Rs. 1,43,140. The expenditure, however, even exceeded this amount, as shown below:—

	Rs.
Establishment and hiring of conservancy carts	45,301
Tank filling	8,536
Land acquisition for improvements	58,799
Road-making and sewering	13,971
Construction of bathing platforms	18,455
Construction of model cattle sheds	11,226
Compensation to hut-owners who were disturbed	1,867
	1,58,254

(7.) *Improvement of Cowsheds and Cattle-Sheds.*—This Department has been under the special superintendence of the Health Officer, who has done all in his power to improve these sheds, but as long as the Commissioners have to proceed against the tenants-at-will, instead of against the owners, the work must be unsatisfactory. According to the Health Officer's Census there are 550 cowsheds in the town bustees, and a very large number of cattle-sheds for draught cattle. Of the former more than half have been connected with the sewer, while 88 have been improved *qua*-drainage and flowing. This has not been effected, however, without painfully-frequent prosecutions, amounting to 1,760 in number.

A commencement was also made during the year in the construction of two model cattle-sheds on land belonging to the Corporation at Kalabagan and Jorabagan. The Engineer undertook the task of erection, and they were substantially though expensively constructed with a lower floor as the stables, and an upper floor for the cartmen to live in.

(8.) *Structural Improvements in the Streets of the Town.*—The proposals of the Sanitary and Structural Improvement Committee for the improvement of the large thoroughfares of the town have already been detailed, and the work done in the improvement of bustees, especially of Jorabagan, has also been related in detail; but, besides this, the Commissioners set aside a sum of Rs. 30,000 annually out of revenue for minor street improvements, and against this grant Rs. 33,848 were actually expended in 1884-85.

ABSTRACT OF REPORT OF THE HEALTH OFFICER FOR CALCUTTA FOR 1884-85.

(Dr. J. O'Brien.)

The returns and report have been prepared for the calendar instead of for the official year, as in the two past years. This change was recommended by the Army Sanitary Commission in their Memorandum on the sanitary report of the town for 1882–83, and approved of by the Town Council at their meeting held on 17th January last. There can be no doubt that the return to the calendar year, as far as the sanitary reports are concerned, is in a high degree desirable. Continuity of record will be thus preserved, and the returns will be far more useful for reference and comparison with the sanitary records of other towns and countries of the civilized world, all of which adopt the calendar year as the period for report.

The meteorology of 1884 was characterized by great drought and excessive heat in the early part of the year. In the preceding year the rainfall was short of the average by 17 inches, and from 1st January to 15th April 1884 the entire rainfall was less than half an inch. The barometric pressure, as shown by the monthly means, was somewhat below the average of the previous year. The months of comparatively lowest pressure were January and July. The temperature of the first two months was considerably below the average, but in March there was a rapid rise [illegible] mean of the month was 0·6° in excess of the average. The heat in April, in the early part of the month, was extreme, and a temperature of 103·7° tered about the 15th, a higher temperature than has been recorded for For the rest of the year the temperature was singularly low. In August below the average, in November 5°, and in December 3·1°. In the early year the humidity was also less than the average.

The rainfall was somewhat below the average, viz., 62·61 inches, against average of the preceding 48 years. The rainfall was chiefly confined to the from May to September. During the first four months hardly any rain fell. 1st January to 30th April the amount collected was 1·75 inches, against 5· average of previous years. The largest fall was in September, viz., 16·63 i against an average of 10·18 inches. In November and December there was practi no rain.

The price of food, though not excessive, was higher than in the preceding year. T dearness of food was the result of the scanty rainfall of the previous year. Scarcity of food was experienced in some of the districts of Bengal; but, beyond a slight rise in prices, there was no distress in the town. Meat and other articles of food in the Municipal Market sold at prices higher than usual in the early part of the year, owing to the influx of people into the town at the time of the Exhibition; but towards the end of the year prices were more moderate.

The registration of births during the year was satisfactory, and shows results better than those of any year of which there is record. Since 1880 there has been a sustained improvement in the registration of births. For the six years prior to 1880 the registered births yielded an average annual ratio of 15·3 per 1,000 of population; but in the four years from 1880 to 1883 inclusive, the average annual ratio rose to 17·2. In the year under review there was a still further increase, and the registered births amounted to 19·1 per 1,000 of population; 8,290 births were registered, against 6,985, the mean of the preceding decade. Former Health Officers have commented on the difficulty of even estimating accurately the real birth-rate of a town like Calcutta, where there is such an abnormal disproportion between the sexes, and where such a large proportion of the population is non-resident. According to the last Census the

population of Calcutta, including the Fort and the Port, consists of 433,219 souls. Of this number 288,817 are males and 144,402 females; that is, there are almost exactly two males to every female.

The birth-rate in England in the 10 years from 1872 to 1881 was 34·4 per 1,000 of population; but this is among a population in which females are slightly in excess of males, the proportion being about 105 females to every 100 males. If we exclude the infructuous surplus of males from the Calcutta population, and calculate the birth-rate in the past year on the female population of 144,402, with the English proportion of males added, viz., about 140,000, we should get a birth-rate of 29·1 per 1,000, or 6·2 short of the English rate. This is a fair rate no doubt, and a considerable advance on any that registration has hitherto afforded in this city. Still, when we consider the large proportion of married women (61·4 per cent.) in the female population at the child-bearing age, that is, between 20 and 40, we are forced to the conclusion that the figures are still short of the truth. In the Census report for 1881 Mr. Beverley goes fully into this question, and, making due allowance for the disproportion of the sexes, estimates that the real birth-rate in the town is about 24 per 1,000 of the ascertained total population. The rough calculation that I give above supports this opinion, and shows that birth registration, though improving steadily, is still imperfect.

During the year several children were vaccinated whose parents could not produce the statutory forms with regard to vaccination which they should have received from the registrars when the births were registered, and it was ascertained certainly in some cases that the births were not registered. All instances of this kind were brought to the notice of the police, with the result doubtless of improving registration. It will be seen on reference to the table that the largest number of births was registered in the last quarter of the year:—

Statement of Births registered from 1874 to 1884.

Years.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	Ratio per 1,000 of population, Census of 1881.
1874 - - -	452	334	348	317	369	343	394	408	392	430	420	456	4,663	10·7
1875 - - -	415	334	393	378	606	570	569	633	650	720	727	606	7,001	16·1
1876 - - -	428	500	576	541	509	566	624	665	710	705	769	719	7,452	17·2
1877 - - -	570	552	588	706	427	491	647	648	709	703	661	755	7,457	17·2
1878 - - -	638	530	611	550	526	489	496	607	573	653	640	612	6,925	15·9
1879 - - -	482	464	450	428	458	430	410	497	604	668	723	795	6,409	14·7
1880 - - -	549	501	497	556	589	480	429	583	668	706	774	784	7,562	17·4
1881 - - -	661	620	599	595	492	548	584	568	605	706	750	730	7,458	17·2
1882 - - -	609	584	664	555	566	504	518	666	653	739	764	683	7,505	17·3
1883 - - -	642	592	618	516	561	503	543	622	643	723	776	695	7,434	17·1
Mean of ten years -	551	591	563	554	509	502	547	589	620	681	700	683	6,985	16·1
1884 - - -	705	630	738	676	598	543	607	716	617	837	825	798	8,290	19·1

The death-rate of 1884 corresponds very closely with the decennial average, viz., 30·5 per 1,000 of population, against 30·4, and this notwithstanding the fact that an epidemic invasion of cholera, unprecedented in severity for the past 14 years, occurred in the months of March, April and May, causing 1,616 deaths, against a mean figure for the same months for the 14 years of 605. Small-pox also prevailed to an unusual extent in the months from February to June, and swelled the total of the year by 478 deaths. But the high death-rate of the first two quarters, due so largely to the prevalence of these particular diseases, was counterbalanced to a great extent by the unusually low mortality of the third and fourth quarters, and by the saving of life throughout the year under the head of fevers and bowel complaints as compared with other years. The general climatic conditions which fostered the virulence and intensity of cholera tended to diminish the prevalence of other classes of disease, especially of fevers. The higher rate of mortality was confined to the first two quarters of the year. The total number of deaths registered during this period was 7,301. In the two later quarters the number fell to 5,955. The figures of the first period exceed the decennial mean by 915, while those of the second fall short of it by 848.

Statement of Deaths from the most prevalent diseases from 1874 to 1884.

Years.	Cholera.	Diarrhœa and Dysentery.	Fevers.	Small-pox.	Other Causes.	Total.	Ratio per 1,000 of Population, Census of 1881.
1874	1,245	1,358	4,461	120	4,343	11,527	26·6
1875	1,674	1,579	5,428	720	4,785	14,086	32·5
1876	1,851	1,864	4,361	71	4,817	12,964	29·9
1877	1,418	1,683	5,151	67	5,385	13,704	31·6
1878	1,238	2,010	6,086	1,495	5,467	16,396	37·8
1879	1,186	1,526	4,796	772	4,774	13,044	30·1
1880	805	1,267	3,797	114	5,698	11,681	26·9
1881	1,693	1,491	3,765	133	5,948	13,030	30·
1882	2,240	1,454	3,618	17	5,848	13,177	30·4
1883	2,037	1,307	3,442	73	5,466	12,325	28·4
Mean numbers	1,549	1,553	4,480	358	5,253	13,193	30·4
1884	2,272	1,209	3,618	478	5,679	13,256	30·5

Compared with the other years of the decade, three years, viz., 1875, 1877 and 1878, show worse results, the remaining seven better.

As regards the mortality according to locality, of the 18 wards into which the town is divided, the three southerly wards, skirting the open maidan, viz., Park Street, Waterloo Street, and Fenwick Bazar, which constitute the European quarter, continue to stand *longo intervallo* at the head of the list as the most healthy. The eastern ward of Puddopooker and the northern riparian ward of Coomertolly maintain their places of 4th and 5th in inverted order, with a death-rate close to the decennial averages. In Bamun bustee and Collingah there is an ascent from 13th and 17th places in the decennial order to 6th and 8th in the annual, the death-rate in the former having descended from 34·2 to 29·5, and in the latter from 38·5 to 31·1. The improved death-rate of these wards exhibits in a very remarkable degree the beneficial effects of the extensive sanitary improvements which have been carried out in them recently. There are several large bustees in each which have undergone extensive structural and general sanitary improvements at the hands of the corporation. Foul ponds have been filled up, and bathing platforms supplying purer river water constructed to replace them. Roads have been made through areas previously covered with densely crowded huts, opening space for ventilation and for scavenging operations. Foul open drains have been filled up and obliterated, sewers laid and houses and house premises connected with them. Hydrants supplying pure drinking water have been introduced. Marshy low-lying places have been raised and drained, and house refuse and surface filth of all kinds have been removed by a regular daily service. In fact, places that were once abominably filthy and ill-kept are now clean and regularly attended to. No weightier evidence of the value of the work that has been done can be produced than the saving of life, which is evidenced by the figures upon which I am now commenting.

The unhealthiest wards during the year were Jorasanko and Hastings, with death-rates of 39·7 and 44·6 per 1,000. These wards were also heavily visited by cholera, the mortality from this disease being respectively 5·4 and 6·8 per 1,000. Jorasanko also suffered more from small-pox than any other ward, the ratio of deaths from this disease alone being 2·9 per 1,000 of population. Hastings, as in other years, maintains its unenviable reputation as the worst ward in the town, and this cannot be a matter for surprise when we consider its condition. The native portion of the ward generally known as Coolie bazar is practically a large and crowded bustee. Surface drainge is most defective, and during the whole of the dry season, lasting from October until June, a large amount of the sewage from houses has no means of escape save by soaking into the ground. The system of underground sewers has not yet been introduced into this ward, and the supply of drinking water is inadequate. The water of Tolly's nullah, a turbid tidal creek much polluted by surface tidal drainage and fœcal matter from several thickly inhabited bustees on either side, and by the crews of the numerous boats plying on its water, is largely used for various domestic purposes, bathing, washing, cooking, and sometimes for drinking. The population of the ward is mainly made up of coolies and lascars, men of the poorest circumstances, who dwell there with their families in miserable ill-drained huts. The proportion of children is larger than in any other part of the town, and they form a class eminently susceptible

to the fatal influences of zymotic disease. A large number of cattle, in addition to those kept by Government, are also stabled in the ward in crowded badly-drained byres and stables, and contribute largely to the uncleanliness of the surface; under such circumstances a high death-rate might naturally be expected. The sanitary state of this ward will, however, soon undergo a complete reformation. The project for draining it thoroughly is now under consideration by the Engineer of the Corporation, and it is expected that it will be sewered completely and connected with the general drainage scheme of the city by the end of the year. Moreover, by the end of 1886, when the additional supply of filtered water is brought into the town, there will be an ample supply of pure drinking water, and thus the two most fertile sources of disease will be removed.

The proportion of deaths, exclusive of still-births, at each age and the proportion of persons living at these ages is as follows:—

—	1884. Per cent. of Population.	Total Deaths.	Per cent. of total Deaths.
Under 1 year	1·4	2,663	21·0
1 to 4	5·0	1,126	8·8
5 to 19	20·4	1,337	10·5
20 to 39	48·3	3,599	28·3
40 to 59	20·2	2,171	17·1
60 and upwards	4·7	1,799	14·1

This statement brings clearly into view the proportion of mortality at different life periods. Though infants under one year constitute but 1·4 per cent. of the population, the deaths among them make up 21 per cent. of the total mortality. The terribly high death-rate of infants is one of the largest and gloomiest items in the bills of mortality of the town. Children between the ages of 1 and 4 form 5 per cent. of the population, and their deaths 8·8 per cent. of the mortality. In the next period, viz., between the ages of 5 and 19, the mortality is lowest. Growing persons at these ages form a fifth of the population, and their deaths only a little over a tenth of the mortality. In the next two periods deaths gain on population, and from 60 and upwards the proportion is 14·1 of deaths to 4·7 per cent. of population.

In the following table the mortality of the town is shown in contrast with that of the suburbs for a period of seven years:—

Years.	Town.		Suburbs.	
	Actual number of deaths.	Ratio per 1,000 of population.	Actual number of deaths.	Ratio per 1,000 of population.
1877	13,704	34·6	14,025	55·7
1878	16,396	37·8	17,459	69·4
1879	13,044	30·1	13,835	55
1880	11,681	26·9	11,216	44·6
1881	13,030	30	11,143	44·3
1882	13,177	30·4	10,470	41·6
1883	12,325	28·4	10,429	41·4
Mean	13,336	30·7	12,653	50·3
1884	13,256	30·5	11,389	45·2

For the four years from 1880 onwards there has been a tendency towards an improvement of the suburban figures as compared with those of the town, but in the year under review, which was decidedly an unhealthy year, the order is reversed, and there is a marked rise in suburban mortality without a corresponding increase in the town. The suburban death-rate in 1884 was 45·2 per 1,000, a rate below the average of the septennial period, but considerably in excess of that of the four immediately preceding years. During the three first years of the septennial period the mortality in the suburbs was extremely great, and the annual deaths reached the high figure of 60·0 per 1,000 of population, but in the four succeeding years the rate fell to an annual average of 42·9 per 1,000.

Suburban Deaths in 1884.

Months.	Cholera.	Small-pox.	Fevers.	Bowel complaints.	Other causes.	Total.
January	52	15	373	184	333	977
February	170	57	284	116	250	877
March	465	45	258	98	211	1,077
April	811	47	340	104	266	1,568
May	301	34	263	83	224	905
June	153	23	226	76	196	674
July	66	11	305	119	293	794
August	41	5	289	122	275	732
September	38	3	305	110	275	731
October	50	2	318	145	294	808
November	127	4	491	180	326	1,128
December	127	4	445	253	289	1,118
Total	2,421	249	3,897	1,590	3,232	11,389
Ratio per 1,000 of population	9·6	·99	15·4	6·3	12·8	45·2

During the past year the high death-rate in the suburbs was largely due to an increase in the mortality from cholera. For the five years since 1880, which was a mild cholera year, the deaths from this disease in the suburbs, in common with those of the town, have advanced in an ascending scale, with one slight intermission in 1883, until they reach their highest point in 1884.

For these years the deaths in town and suburbs were as follows:—

	Cholera deaths.	
	Town.	Suburbs.
1880	805	980
1881	1,693	1,879
1882	2,240	2,349
1883	2,087	2,132
1884	2,272	2,421

The question of the relative intensity of cholera in Calcutta and the neighbourhood is discussed more fully in a subsequent paragraph. Here I may briefly say that the amount of the disease in the suburbs is practically almost double that of the town, for, with a population in the proportion of 62 persons to every 100 in the town, the cholera deaths last year were at the rate of 106 in the suburbs to 100 in the town.

In the above table the deaths in the suburbs from the principal diseases are shown. The mortality was as follows:—Cholera 9·6, fevers 15·4, bowel complaints 6·3 per 1,000 of population against 5·2, 8·8 and 2·7, the rates of the same diseases in the town. From this it will be seen that fevers and bowel complaints as well as cholera prevailed with far greater severity in the suburbs than in the town; on the other hand, the casualties from small-pox were less, viz., 0·99 against 1·1 in the town.

In the succeeding paras. the mortality from particular diseases is discussed. Though the mortuary statistics may be accepted as almost absolutely correct as far as the total mortality is concerned, the information which they afford as to the number of deaths from particular diseases can only be regarded as an approximation to the truth. Probably not one-fourth of the persons who died during the year were attended by properly qualified medical practitioners, and as medical certificates as to the cause of death are not compulsory, they were produced in but a very small number of cases. However, it would be safe to say that the statistics are improving in this respect from year to year, and that as the value of mortuary registration is more generally appreciated, a high standard of accuracy will gradually be attained. The cholera figures are doubtless the closest to the truth. Cholera is the one disease above all others in which from the sudden nature of the invasion, the striking symptoms during the attack and the rapid termination in death, fewest mistakes are likely to be committed. Small-pox also would seem to be a sufficiently striking malady to admit of few errors in diagnosis by even an ignorant observer, but during the year several cases of reputed small-pox were reported which, on examination by the officers of the Vaccine Department, turned out to be chicken-pox or measles. Under the general classification of fevers it is probable that many deaths due to pneumonia and other internal inflammatory disorders are registered.

The year has been a favourable one as regards fevers. The deaths registered under this head amounted to 3,618, or 27 per cent. of the total mortality. The total is less than that of eight years of the preceding decennium and 862 less than the average of the decennium. 1883 is the only year in which the fever mortality was less; in 1882 it was exactly equal. Since 1879 there has been a very remarkable and sustained reduction in the fever mortality of the city. During the years from 1874 to 1879 the average annual number of deaths was 5,030, in the four succeeding years, 1880 to 1883, the average fell to 3,655, or nearly 1,400 less, and in the past year the total was 3,618. The diminution in mortality from diseases of this class would appear to keep pace with the extension of the system of underground sewers and with the improved surface drainage and reduced soil moisture which follows the introduction of sewers into undrained localities. Foul cesspools and open drains which are little better than chains of cesspools become obliterated, and house sewage and surface water is rapidly and inoffensively removed, instead of remaining to stagnate and putrefy on the surface. With regard to the local prevalence of fevers, Hastings stands at the head of the list with a mortality of 15·5 per 1,000, against 8·9, the rate of the entire town. The system of underground drainage has not yet been introduced into this ward. Liquid sewage is collected into numerous reservoirs large and small, and removed by means of carts. The method works badly, and sewage constantly stagnates in the drains, escapes from the reservoirs and pollutes the soil. Accordingly, we find that the fever mortality of this small ward maintains a high level from year to year. For the past five years the death-rate was as follows compared with that of the rest of the town:— Fevers.

	Hastings.	Town in general.
1880	18·6	8·8
1881	20·1	8·6
1882	13·7	8·3
1883	19·1	7·8
1884	15·5	8·3

It is satisfactory to be able to report that the necessary funds have been allotted in the Budget of the current year for the thorough drainage of this ward. With an efficient system of well flushed underground sewers, and an increase in the supply of pure drinking water, it ought to become a very healthy ward.

There was no unusual prevalence of any particular form of fever during the year. Enteric fever, as in former years, was conspicuous by its absence. Only nine deaths from this disease were registered. Of these five occurred among Non-Asiatics.

In the following table the deaths from cholera, month by month, for the past 20 years are shown. 1884 completes the twentieth year. Cholera.

Years.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	Ratio per 1,000 of population, Census of 1861.
1865	136	396	508	756	400	131	162	394	496	482	317	452	5,978	11·7
1866	509	826	1,193	736	616	385	352	491	971	236	203	209	6,896	13·7
1867	67	142	292	343	345	127	108	54	150	277	243	140	2,270	5·2
1868	252	328	694	591	360	174	97	395	198	350	405	352	4,186	9·6
1869	264	428	739	745	697	336	77	52	40	56	77	57	3,582	8·2
Mean numbers	245	424	689	634	477	332	199	273	249	276	249	241	4,398	10·1
1870	171	259	257	381	165	113	50	40	29	36	21	31	1,558	3·5
1871	53	96	56	85	29	23	25	41	69	85	127	108	796	1·8
1872	77	78	61	67	63	52	68	76	57	89	177	244	1,102	2·5
1873	129	185	217	159	139	96	55	22	22	20	23	24	1,105	2·5
1874	62	175	186	243	210	79	45	39	17	22	60	124	1,245	2·8
1875	126	69	264	264	115	63	28	31	50	145	353	167	1,674	3·8
1876	90	226	324	268	168	126	42	33	31	41	259	244	1,851	4·2
1877	251	130	174	184	76	28	26	77	119	192	85	108	1,410	3·2
1878	65	98	312	308	131	47	39	37	45	34	84	116	1,333	3
1879	73	58	145	175	318	223	56	31	19	17	21	60	1,186	2·7
1880	71	114	90	71	47	11	17	22	18	55	170	119	805	1·8
1881	63	72	227	370	138	36	49	59	80	100	232	267	1,693	3·9
1882	129	111	170	318	380	254	54	52	38	91	232	411	2,240	5·1
1883	204	129	227	490	393	139	38	38	38	162	103	85	2,037	4·7
Mean numbers	112	129	193	242	170	92	42	43	45	75	139	150	1,432	3·3
1884	36	123	486	847	283	129	54	29	44	49	118	76	2,272	5·2
Suburban, 1884	72	170	465	811	361	153	66	41	38	50	127	127	2,421	9·6

Reviewing this epoch according to the quinquenniums into which we find it almost naturally divided by the variations of the intensity of cholera, we have first what might be called the pre-sanitary period—the period prior to the great sanitary event of the introduction of a pure water supply—extending from 1865 to 1869. During this period cholera maintained what may be termed a maximum rate. The total deaths were 21,942, and the yearly average 4,388. Next follows a period of minimum prevalence, the lowest figures being found in 1871, the lowest for the whole 20 years. The total deaths in these five years were 5,806, and the yearly average 1,161. In the two succeeding periods we find gradually rising figures, marked by an intermission in the years 1879–80. In the first of these later periods, viz., from 1875 to 1879, the total deaths were 7,467, and the yearly average 1,493, while in the last quinquennial period the total rose to 9,407, and the yearly average to 1,809. Thus then, though the general prevalence of cholera is vastly diminished as compared with the period antecedent to 1870, we find that there is a tendency towards exaltation in the mortality from the disease during the past 10 years. How is this increase to be explained? *Primâ facie* it would appear reasonable to conclude that the health conditions of the town have disimproved of late, and that the increased cholera is due to an increase of filth and to growing defects of conservancy. But so far from this being the case, we have convincing evidence that it is not so in the report of the Commission appointed by Government last year under Section 28 of Act IV. of 1876, to inquire into the sanitary state of the town. The Commission submitted its report in January of the present year (1885). The following extracts from the report refer to some of the sanitary improvements that have been carried out in the town within the last eight years:—

Para. 8.—Acknowledgment of work done * * * * * *

"Our inspections have satisfied us that real and solid progress has been made in the path of sanitary improvement, and it is, as we conceive, our duty to report this fact to the head of the Government from whom we derive our Commission. One of our body, Mr. Beverley, can speak from personal experience on this matter. In 1876, shortly before the present municipal constitution came into being, Mr. Beverley was charged with the duty of taking a census of the town, and in the course of those operations there was almost no part of the town that he did not visit; in 1880, again, he acted as Chairman of the Corporation for upwards of seven months; and in the following year he was again employed to take a census of the town. Mr. Beverley is thus in a position to compare the state of the town at the present day with what it was eight and four years ago respectively, and it gives him great pleasure to be able to place on record his personal testimony as to the great improvements that have been made, more especially within the latter period. That these improvements have benefited the town from a sanitary point of view cannot, we think, admit of doubt, though the fact may not be capable of easy demonstration from the mortuary returns.

"According to the last Annual Report (1883–84) the mileage of sewers completed appears to be as follows:—

	Miles.
First and second class (brick) sewers -	36·77
Third class (pipe) sewers - -	127·79
Total	164·56

"It would seem, therefore, that during the last seven years something like 80 miles of sewers have been laid, or nearly half the total mileage. It is true that the sewers laid during that period have been almost exclusively pipe sewers, the labour and cost of laying which is not to be compared with that of constructing the first and second class (brick) sewers. On the other hand, it is the laying of these pipe sewers that completes and gives its utility to the entire system. It is the branch sewers that collect the material for the principal sewers by providing facilities for drainage all over the town. They not only carry off house sewage and kitchen slops that would otherwise sink into and pollute the soil, but they also drain off rain-water, and so tend to keep the surface of the ground dry and wholesome. In other words, they take the place of the old open public ditches, which have to a great extent been obliterated. It would appear that during the last eight years over 31 miles of these ditches have been sewered, and we are informed that not more than four or five miles of them now remain to be dealt with.

"Till within the last four years little or nothing had been done to improve the bustees of the town. . . . The first bustees taken up under Sections 280 and 284 were Seortee Bagan and Patwar Bagan, and since then several other bustees in the town have been dealt with under these Sections. In order to show the sort of work that is being effected in this direction, the following table has been compiled from information supplied in the annual report for 1883–84 for those bustees in which the operations have been completed :—

Name of Bustee.	Area of Bustee in Bighas.	Length of new Bustee Roads made.	Area of such Roads.	Length of Surface Drains.	Length of Sewers laid.	Amount referred by the Corporation.
		L. ft.	S. ft.	L. ft.	L. ft.	
Seortee Bagan - -	64	5,080	50,375	4,655	2,055	28,768
Patwar Bagan - -	40	1,695	13,055	1,885	—	728
Jorapooker and Gowalapara -	9	1,397	12,573	1,397	—	Not given.
Baman Bagan - -	25	1,380	15,590	1,380	—	Do.
Kola Bagan - -	60	5,000	53,340	4,040	1,800	Do.
Total - -	198	14,552	145,033	13,357	3,855	—

"The roads made through these bustees are generally of a width of 9 feet, sufficient to admit conservancy carts for surface-cleansing; the sewers laid under the bustee roads provide facilities for efficient drainage when the various groups of huts are properly and fully connected.

"Besides the above, the work of reconstruction is also in progress in—

	Area.
Nather Bagan - - - - - -	16 bighas.
Colvin's bustee - - - - - -	56 "

and measures have been taken to bring the following eleven bustees under the operation of Sections 280–283 :—

	Area in Bighas.		Area in Bighas.
Kalakur - -	5	Parseebagan - -	20
Phoolbagan - -	7	Soorhatta - -	3
Pathuriaghata - -	9	Keraneebagan - -	24
Lalbagan - -	17	Kristobagan - -	45
Shaikpara - -	4	Ooryapara - -	25
Kaloo Ghose's Bagan -	24		

"In order to facilitate the reclamation of bustees, the legislature in 1881 conferred on the Corporation the power of acquiring them for the purpose of improving them, and during the current year this provision of the law has been acted on in the case of a portion of the Jorabagan bustee. That bustee is now in process of being entirely remodelled.

"In addition to the reclamation of bustees under Sections 280–283, the corporation have recently entertained special establishments for surface cleansing in the manner attempted by Dr. Payne in 1877. This bustee establishment began to be organised from the commencement of the year 1883–84, and the greater portion of the bustees have now been taken in hand and are being cleaned by its agency. This subject will be more fully treated when we come to discuss the recommendations we have to make.

"In the matter of general conservancy the Commissioners have introduced several improvements of greater or less importance. In 1877 the Corporation organised a municipal *halalcore* or latrine service, in place of the tola mehter system which existed formerly. The matter will be treated at length when we come to discuss the latrine system, but it is perhaps not too much to say in this place that, with the present insufficient water supply, this reform may be reckoned among the greatest boons ever conferred upon the town. For some time past again, the Corporation have been pursuing, with more or less energy, the policy of filling foul tanks in bustees, with the result that, in the last eight years, no fewer than 178 such tanks have been obliterated. Within the last three years the cleaning of the sewers has received special attention, and been placed on a more efficient footing. A system of inspection of house drainage connections has also been organised. The hackney stables have been passed and drained, and determined efforts made with more or less success to improve the disgraceful state of the cowsheds in gowalla bustees. The

conservancy arrangements have been further improved by the organisation of an experimental service for removing the droppings of horses and cattle from the public streets during the day. And latterly the Commissioners have shown some energy in constructing bathing platforms to provide the means of ablution in place of the large number of tanks which have been filled or the water of which has been condemned. These may not all be great measures of reform, and some of them may perhaps be found not to go far enough; but they have all tended to improve the sanitation of the town, and deserve to be fully taken into account in considering its present condition. They will accordingly be referred to at greater length hereafter, when we come to treat of the recommendations we have to make."

With this evidence of the gradual improvement that has been effected in the sanitary condition of the town before us, it would be manifestly incorrect to ascribe the augmentation of cholera to progressive insanitation. Intensity of cholera in a particular area may be said to depend on three main factors, viz., local insanitation, personal receptivity on the part of the population, and climatic causes. Local insanitation is certainly, as the experience of this city teaches, the chief and most potent agent in producing the disease, and that this condition still prevails to a wide extent in the native part of the town is a fact but too well known. But the state of things was equally bad, indeed it may be affirmed, certainly worse, in the years when the intensity of cholera was at a minimum. The second factor, viz., personal receptivity on the part of the populations remains the same as in former years. The population of the town, now as then, is largely recruited by immigrants from districts in which cholera is not endemic, and these form a class, as the mortuary returns of the town show, highly susceptible to cholera. We are then driven to seek in the last factor, viz., general climatic causes, for the explanation of the increase in the prevalence of the disease in late years. The influence of this factor can be determined by contrasting the mortality from cholera in Calcutta for a series of years with that of the neighbouring towns and districts. Allowing, as we may fairly do, that the sanitation of these places does not vary much from year to year, we nevertheless find that the amount of cholera varies greatly in different years. The accompanying diagram (not reproduced in this abstract), which I have extracted in part from the report of the Commission above referred to, illustrates the comparative intensity of cholera in the districts of Lower Bengal lying close to Calcutta, viz., Nuddea, 24-Pergunnahs, Howrah and Hooghly, including Serampore and in the town of Calcutta, Howrah and the suburbs for a period of eight years. This diagram to my mind shows very clearly that, other things being equal, the intensity of the disease in the town from year to year is regulated to a very large extent by general climatic causes which affect equally the large tracts of country comprising the neighbouring districts. If one were to examine the town figures alone, he might be inclined to attribute the increase of cholera to some local cause, to think that perhaps it was connected with the filling of the tanks, or that it was due to the extension of the system of underground sewers, or to the introduction of unfiltered water from the river into the bathing platforms, or to some other cause operating within the confines of the town, but a glance at the diagram would refute such theories and show that the intensity of cholera from year to year is mainly regulated by causes which govern equally the distribution of the disease in districts in which no such conditions exist.

Thus in 1878 we find that the disease prevailed in the four areas selected for comparison at a high level, highest in the suburbs, high in Howrah, much lower in Calcutta, and still lower in the rural tracts of the neighbouring districts. In 1879 we find a marked descent in all four, but the relative levels are maintained. In 1880 there is a still further descent, and the disease is everywhere at a minimum. In the four succeeding years we find a steady increase with one intermission in all the areas, until the highest point is reached in 1884. Both in increase and in intermission the relative levels are maintained. The diagram appears to illustrate very clearly the influence of general climatic causes, and to show that the increasing prevalence of cholera in the town of late years has been due mainly to them.

It is satisfactory here to be able to state that in the present year 1885 cholera shows a tendency to assume a more favourable course than that which it maintained in 1883 and 1884. The deaths in the first five months of the year, as compared with these years, were as follows:—

	January.	February.	March.	April.	May.	Total.
1883	204	129	227	490	393	1,443
1884	36	123	486	847	283	1,775
1885	79	153	242	356	147	977

From these figures it would appear to be safe to augur that cholera is about to return to the more moderate proportions of the earlier years of the decade. The lesser mortality of the present year, I have no hesitation in saying, is due in a great measure to more favourable weather. In 1884 there was a great drought and intense heat; in the first four months in the present year, the heat has been tempered, and the surface moistened by seasonable showers, and the wind has blown more frequently from the north.

As regards the localisation of cholera, the densely crowded and insanitary riparian wards of Jorabagan and Burra Bazar suffered most, the death-rate being 9 and 7·9 per 1,000 of population, while the mortality in the whole town was 5·2. The rate in these wards was also comparatively high in the decennial period. They are pre-eminently stranger's wards, being to a very large extent occupied by immigrants from up-country who come into the city for purposes of trade. For instance, the population of Jorabagan is composed of 24,324 males and of 11,994 females, and of the males nearly 18,000 or 70 per cent. are at what might be called the business-age, that is, between 20 and 40. In Burra Bazar the disproportion between the sexes is still greater, viz., 16,122 males and 4,647 females, and the proportion of males between the age of 20 and 40 is the same as in Jorabagan. This shows to what a large extent the population is non-resident. It is chiefly immigrant and fluctuating and reinforced by frequent additions from outside. From the Census Report of 1881, I find that only 11 per cent. of the population of Burra Bazar are natives of Calcutta, and of Jorabagan only 18 per cent. A population of this kind is, as I have stated in a previous paragraph, highly susceptible to the endemic influences which cause cholera. The following statement, which I have received from Dr. Sanders, the Superintendent of the Mayo Hospital, shows to what an enormous extent new arrivals in the town fall victims to these fatal influences:—

Cholera Cases admitted and died during the Year 1884 *in Mayo Hospital, Calcutta.*

Year.	Under 3 Months.		Over 3 and under 6 Months.		Over 6 Months and under 1 Year.		1 Year and over.		Total.	
	Admitted.	Died.	Admitted.	Died.	Admitted.	Died.	Admitted.	Died.	Admitted.	Died.
1884	179	77	39	19	43	16	75	38	336	150

The total number of cases of cholera treated in the hospital in 1884 was 336, and of this number 261 or 77 per cent. were residents in the city for less than one year, and 179 or 53 per cent. were residents for less than three months. I have extended the same inquiries in other directions with the result of confirming the experience gained in the Mayo Hospital, and of showing in what a remarkably high proportion strangers in the town suffer from cholera.

Next to Jorabagan and Burra Bazar, Hastings, Coomertolly, Shampooker, and Burtollah suffered in proportion to population, the mortality varying from 6 to 7 per 1,000. In Jorasanko, Sukea's Street and Colootollah the mortality was also high, the rate ranging between 5 and 6 per 1,000. In the southern wards the mortality was comparatively low.

Bowel complaints.

The registered mortality from dysentery and diarrhœa was unusually low during the year. The total number of deaths from these diseases is less than that of all the years of the preceding decennium and 344 less than the mean of the decennium. In other years when cholera prevailed at a high rate, diseases of this class were also rife; but the past year forms an exception to the rule, for, with a high cholera mortality, we find a great reduction in the number of deaths from bowel complaints. It might be suggested in explanation of this fact that some of the deaths due to bowel complaints were registered as cholera; but this would be merely a surmise incapable of proof. We must take the figures as we find them, and believe that the mortality from bowel complaints as well as that from fevers was at a low ebb during the year.

Small-pox.

Under small-pox 478 deaths were registered, a larger number than has been registered in any year since 1879. The history of Calcutta shows that it has been periodically visited by epidemics of small-pox. Statistics show that an outbreak more or less severe occurs every four or five years. The last great epidemic occurred in 1878-79.

In these two years the deaths amounted to 2,267. In former epidemics the mortality was much greater. Thus in the great epidemics terminating with that of the years 1864–65, the average number of deaths was 3,873, whereas in the later epidemics of 1874–75 and 1878–79 the average fell to 1,583, or less than half the mortality of the earlier epidemics. Another fact is noticeable with regard to these epidemics, viz., the more severe the visitation the longer and more complete the period of immunity that ensued. For instance, the great epidemic of 1849–50 with 6,154 deaths was followed by five years in which the average number of deaths from small-pox was 56, and the outbreak in 1864–65 in which 5,556 persons died, was followed by a lull of eight years in which the annual average was 54. On the other hand, after the milder epidemics of later years, epidemics that have been mitigated and curtailed by vaccination, the period of immunity, as might naturally be expected, has been neither as long nor as complete. For instance, the epidemic of 1874–75, in which 900 deaths occurred, was followed by only two years of comparative freedom from the disease. In 1878–79 it broke out again, and slew 2,267 persons. In the four succeeding years, 1880 to 1883, the average annual number of deaths exceeded 80, and the disease again assumed an epidemic form in 1884. The fact would appear to be that a severe epidemic visitation of small-pox protects the town in a more thorough and complete manner than a mild epidemic does, even with the aid of augmented vaccination. A severe epidemic attacks all, old and young alike, whereas vaccination, with the help of which and segregation recent epidemics have been stamped out, has been confined chiefly to the protection of the young. The Compulsory Vaccination Act aids mainly in securing this result, but up to the present no efficient means have been devised of securing the protection of the thousands of adult emigrants who swarm into the city year after year either for permanent or for temporary residence. Even with the aid of the increased vaccine establishment sanctioned last year, it was found most difficult to push vaccination to any great extent among people of this class. But the importance, nay the necessity of doing so, may be gathered from the following figures. During the past year 451 cases of small-pox were reported by the Police and by the Inspectors of Burial Grounds and Burning Ghats. Careful inquiries were made in each case by the officers of the Vaccine Department, and it was found that out of the total number no less than 335 or 74 per cent. were immigrants, and had been dwelling in the town for less than one year. These figures are conclusive in showing to what a large extent outbreaks of small-pox are due to the immigration into the town of unprotected persons from outside. It will be always most difficult to secure the complete vaccination of people of this kind, or even to ascertain their existence unless a Census is made from time to time for the purpose of ascertaining the state of protection of the population against small-pox. The house-to-house visitation and inquiries which have been recently introduced fail to a great extent. In huts and lodging houses, for instance, the male occupants are, as a rule, absent at work during the day, and adult females object to examination, so that numbers of unprotected persons escape the inquisition of the vaccinators. From year to year unprotected persons of this kind accumulate, until at length the pabulum of an epidemic is provided.

Other causes.

There is not much to remark under other causes of mortality. The total number of deaths registered was 5,679, against 5,253, the mean of the decennial period. Three years, viz., 1880, 1881 and 1882 show a large number of deaths from "other causes" and seven a smaller number. It is difficult to explain the variation of these figures from year to year.

Vaccination.

The number of persons vaccinated during the year was considerably in excess of the average of former years. The increase of small-pox in the hot weather caused much alarm, and gave rise to the idea that a severe epidemic, rivalling those of former years, was at hand. Accordingly on 23rd May, at the request of the Health Officer, 6 extra vaccinators were sanctioned by the Commissioners for 2 months, and at the end of this time, viz., on 23rd July, the following permanent additions were made to the vaccination establishment, viz.:—

1 Assistant Superintendent, a qualified medical practitioner.
1 Female vaccinator for work in zenanas.
7 Vaccinators.

The vaccination establishment of the town now consists of—

1. The Deputy Superintendent.
2. The Assistant Superintendent.
3. 21 Vaccinators.
4. 1 Female vaccinator.

Thus we see that the establishment has undergone an increase of 50 per cent. during the year.

The outturn of work resulting from this increase has been satisfactory in a high degree.

The numbers vaccinated in the town for the past 5 years were as follows:—

	Vaccinated.	Re-vaccination.	Total.
1880	5,349	1,398	6,747
1881	5,522	1,016	6,538
1882	7,273	529	7,802
1883	8,649	2,450	11,099
Average	6,698	1,348	8,046
1884	13,571	2,092	15,663

From this statement it is seen that the total number of vaccine operations performed in 1884 were almost double the average of the 4 preceding years, and in the case of primary vaccinations the number was more than twice the average. The statement is also instructive in showing the steady and rapid progress that vaccination is making from year to year in the town. We have, however, now reached a figure which I do not think it will be easy to exceed or even to sustain in future years. The primary vaccinations last year were over 50 per cent. in excess of registered births; in other words, this number of unprotected persons (mostly children) were sought out and vaccinated. But it is obvious that this process cannot go on continually. The number of unprotected children must, under the present system, decrease from year to year, and so eventually must the number of vaccine operations.

The peculiar feature of the work last year was, that it was pushed on with equal vigour all the year round without the interruption of a recess in the hot weather and rains as in former years. In the hot weather, when small-pox was prevalent, bustee vaccination and vaccination in the immediate neighbourhood of infected houses was enforced as far as possible. With regard to vaccination in the months from April to September, I can state from the observation of large number of cases that it runs almost precisely the same course, and is as safe and as efficient in the protection which it confers as vaccination in the cold weather. In fact the experience gained last year goes to prove that the popular prejudice against vaccination in the hot weather and rains is altogether unfounded. 4,940, or close on a third of the total number of operations in 1884, were performed between April and September.

Notwithstanding the considerable increase made in the vaccination establishment, it is satisfactory to be able to report that the actual cost of each vaccine operation was less than in the previous year. The average cost of each successful case was 8 annas against 9 annas 7 pie in 1883, and if the fees realized by home vaccination be deducted from the total expenditure, the cost of each case is 7 annas 2 pie, against 8 annas 10 pie in 1883.

With regard to the character of the vaccine work I may say that I made regular weekly inspections of the vesicle, and found it as a rule excellent. The lymph was frequently renewed from the calf, and typical vesicles were the rule. The habit is to vaccinate with two spots on each arm. In probably 90 per cent. of the cases four spots were successful, a high per-centage no doubt, but not surprising when it is remembered that arm-to-arm vaccination or vaccination direct from the calf is always practised. Neither tubes, glasses, nor points are allowed.

Sanitary work.

The improvement of bustees occupied a good deal of attention during the year, and several large bustees were taken up for structural and sanitary improvements. The projects for improving them are under consideration, and will be carried out in due time. No more useful sanitary work can be undertaken than that of remodelling and improving these extremely crowded and ill-drained localities.

The surface cleanliness of bustees was efficiently maintained by the staff of coolies and dhangurs employed for this purpose by the Corporation.

Drainage.

Much attention has been devoted to the drainage of bustee lands. In the smaller bustees, and blocks of huts where drainage is defective, notices have been served on the landlords requiring them to improve the drainage of the land. A large amount of drainage has been carried out in this way, and the work is being pressed on every day.

One steady object has been held in view throughout the year, viz., to confine sewage in surface drains of masonry falling into the sewers, and to prevent as far as possible its escape over the surface. In every part of the town work of this kind is in progress.

Nuisance department.

The following return will show the work done by the Nuisance Department as far as privies are concerned :—

Number of privies on the revised list - -	28,913	
Do. undertaken - - -	1,172	
		30,085
Less number in which services discontinued - -		511
Total number now served - -		29,574

Many difficulties have been encountered in demolishing and remodelling old privies of faulty construction, and in having new ones built on the standard plan to replace them.

Pipes or service drains with cement plastering or pointing have been insisted on in all cases to prevent the escape of urine and washings from privies and to convey them to the sewers. The people of the lower classes can with difficulty be got to understand the advantages of these drains, and they place many obstacles in the way of their construction, chiefly on the score of expense. However, obstruction has been steadily overcome, and privy drains in large numbers have been connected with the sewers, either singly or by a joint operation on the part of contiguous hut-owners. In fact these drains, now rapidly extending, form a prominent feature in every bustee. In cases where the sewers are at too great a distance from bustees, and in those parts of the town which are yet undrained, *e.g.*, Hastings and Bagh Bazar, mason receptacles for washings from privies are allowed. The receptacles are cleaned daily, and the liquid sewage matter thrown into the nearest discharge depôt.

In connection with the Nuisance Department work 68 foul wells were closed in private premises during the year. Privies are not allowed to be constructed within 20 feet of a well; so to obtain the necessary sanction for the construction of new privies, many wells in small-house premises had to be closed. When the additional supply of filtered water reaches the town, it is to be hoped that a law will be introduced compelling the closure of all the wells in the town. At present it would be premature to close all the wells, as the supply of filtered water is inadequate to the wants of the people in many localities, and water of some kind has to be used for washing clothes, cooking utensils, bathing and many other domestic purposes. In fact, if all the wells were shut up at present, a very large amount of the water necessary for keeping the sewers in order would be withdrawn. But when the new supply of filtered water reaches the town, all objections to the closure of wells will be removed, and vigorous measures should be taken to obliterate them. The water in these wells, as has been frequently pointed out, is most impure, and on analysis gives results worse than ordinary sewage.

The work of dewatering and filling tanks has been vigorously carried out during the year. On the requisition of the Health Officer several foul tanks were dewatered. The total amount of work done in this direction during the year was as follows :—

(1.)	Number of tanks on the condemned list -	50
(2.)	,, dewatered - - - -	9
(3.)	,, filled with refuse and earth - -	20
(4.)	,, being filled at end of year - -	17

The number of tanks filled in a particular year depends entirely on the size of the tanks; hence, though the amount of work actually done may be the same, the number of tanks actually filled must vary greatly from year to year.

In connexion with the filling of tanks, the question of bathing platforms naturally arises. The filthy tanks have hitherto been used almost exclusively by the lower classes for bathing purposes. As they get obliterated it becomes absolutely necessary to provide other water for bathing. Several bathing platforms were constructed during the year, and at the close of the year 30 were in working order. The Commissioners have sanctioned the construction of an additional 30 platforms in the current year, and the Health Officer has been asked to select sites for them. Some 50 suitable sites have been chosen, and out of these 22 have been selected for the immediate construction of platforms. The remaining eight sites will be fixed in the localities which need them most.

The platforms are fed by water pumped every day from the river. They are the greatest possible boon to the people, and are immensely appreciated by them. Numerous petitions and applications asking for platforms in particular localities have been received during the year. I have had a census made of the number of bathers in some of the platforms, and I find that the average is from four to five hundred people per diem in each. When the additional supply of filtered water reaches the town, it is to be hoped that a sufficient quantity will be available to feed the platforms. The water pumped into them from the river opposite the town, though infinitely better than average tank water, is by no means pure. In fact, it does not come within the class of potable water, and, considering the reckless habits of the lower classes, I think none but a water that may be drunk with impunity should be supplied in the reservoirs of the platforms. During the cold and dry seasons, extending from November to May, the river water near the town is highly brackish, and its use predisposes to attacks of diarrhœa and cholera.

Considerable attention has been paid to the improvement of the numerous filthy, badly drained, over-crowded cowsheds which exist in various parts of the town. A large number of these sheds, especially in the southern wards, have already been improved, and are extremely clean and well kept; the cattle stand on floors of wood or masonry, and the drains are in good order and connected with the sewers; but in the northern and central wards a large number are still in a very defective state. There are altogether about 550 sheds for milch cows in the town. Of these over 300 have now been connected with the sewers by means of brick drains. During the past year 88 sheds and premises have been improved in the matter of drainage, sewer connexion, and flooring of the stalls. Masonry receptacles or chowdachas have also been constructed in 42 sheds, and notices have been served in several other cases in which the work is not yet complete.

The Inspector appointed to the special duty of improving the sanitary condition of Jorabagan and Burra Bazar organized a self-supporting establishment, which did much useful work without any cost to the Corporation. The owners of premises found in a filthy state were ordered to have them cleaned out under pain of prosecution, at the same time the Inspector gave an estimate of the cost of the necessary work, and in a large number of instances he was asked to get it done by the self-supporting establishment. The total amount received for work of this kind from July 1884 to 31st March 1885 was Rs. 1,134. Work of a similar kind is now carried out by the other Inspectors: but there are few parts of the town in which houses and house enclosures are found in such a filthy state as they were in Jorabagan and Burra Bazar when we commenced work in July.

ABSTRACT OF REPORT OF THE MADRAS MUNICIPALITY FOR 1884-85.

(Mr. G. T. Mackenzie.)

Drainage.

The pumping station at Royapuram was formally opened by His Excellency the Governor on June 30th, 1884. The drainage from the eastern and north-eastern sections of Black Town, and also the sewage taken from the main drain near the Fort by the pumping engine into the intercepting sewer, flows to this spot and is raised and delivered through a two foot main, nearly one mile in length, to an open elevated channel which leads it northwards to the sea. Very little sewage escapes into the sea. Almost all is supplied as a fertilizer to the land on either side of the channel.

Difficulties were experienced in the work of constructing the sewers which form portion of the Black Town scheme. The heavy rains of 1883 caused an excess of water in the subsoil, and the rains of 1884 in Madras were worse and seriously impeded the works in progress. Sewer No. 1 was commenced in March 1884 and 2,012½ feet were constructed. In sewer No. 2, 510 feet of 12-inch pipe, 3,822 feet of 18-inch pipe, and 1,003 feet of two foot brick sewer were constructed. The work has been inspected by several officers of the Public Works Department. The nature of the soil and the enormous flow of water will increase the cost much above estimate, but no way of escaping this expense suggests itself.

The surface drainage of the eastern portion of Black Town between Popham's Broadway and the sea is almost complete. More than 70,000 feet of surface drain were laid during the 15 months, while 489 house drains were altered by the municipality and 1,316 by the owners. The opportunity has been taken to widen and improve several streets.

Diversion of Drains from the Cooum.—In Poodoopett a plot of land measuring more than 22 acres was purchased and, a parcherry being removed from it, was levelled to serve as a sewage farm for the disposal of the contents of a large drain which flows into the Cooum.

Water supply.

Advantage was taken of the low level of water in the Red Hills Lake to commence the off-take tower in the deepest part of the lake, which is portion of the new water supply scheme for a supply by pipes from a filtration bed at Red Hills. This work was executed from the Rs. 75,000 which Government contributed. It was pushed on vigorously, and since the commencement of the current year the machinery has been received from England and the work has been completed.

Extensions of the existing water-supply were made to Royapuram and Cassemode and a larger main was laid in Monegar Choultry Road, at a cost of Rs. 6,768.8.9.

The cyclone of the morning of November 21st completely breached the Red Hills Reservoir and the whole supply of water was lost. For 10 days the city had only a partial supply from Trevelyan Reservoirs and the Seven Wells, aided by rain water from the Red Hills channel, but on December 2nd water from Koratur tank was led into this channel and a supply was thus obtained until February 2nd, when the temporary bund erected at Red Hills by the Department of Public Works raised the water above the level of the off-take pipes and again supplied Madras with Red Hills water.

Although it does not fall within the period under report, it may be convenient here to mention that in May the water fell below the off-take pipes and since that date has been raised by steam pumps, three engines being kept working night and day. The cost of this and of the previous operations at Koratur has been debited to Temporary Water Supply, and remains to be adjusted, there being no Budget provision.

Conservancy.

The expenditure on conservancy in 1883 was Rs. 2,42,531.5.11, and in 1884 Rs. 2,53,093.3.1. The increase arose chiefly from the expenditure on the new pumping station at Royapuram and on the salary for six months of a Special Sanitary Officer.

The expenditure during the 15 months was Rs. 3,28,550.8.3. In cleaning the main drains Rs. 8,688.11.9 were spent, and this exceeds the estimate, the reason being that the heavy rains at the close of 1884 filled the drains with silt to an extent much in excess of the amount expected, and when this silt was removed the actual work done at a fixed rate per cubic yard was paid for. The item of Rs. 3,750 in the Budget for repair of carts, boats, and buckets was exceeded, the expenditure being Rs. 4,410.10.5. This was caused by an emergent expenditure of nearly Rs. 1,000 in the repair of the nightsoil barges on the canal. The expenditure on contingent charges was Rs. 5,261.7.1 in 1883 and rose to Rs. 7,491.9.0 in 1884, and to Rs. 9,090.3.8 in the 15 months. One cause of this increase was the cost of clearing silt from the canal basin and certain street drains, which alone amounted to nearly two thousand rupees.

The system of conservancy followed did not differ from that of previous years. 1,189 coolies, 598 carts, and 6 canal barges were employed, and removed 462,984 cart loads of rubbish and silt and an amount, estimated at 63,354 tons, of nightsoil. The fourth, fifth, and eighth divisions are yet without any system of house conservancy. It is very necessary that house conservancy be extended, as soon as possible, to Vepery, Royapettah, and St. Thomé. The real difficulty in maintaining a proper system of conservancy in Madras arises from the unruly temper of the scavenger class, as is pointed out by Surgeon Davis in his report. This difficulty is increased by the fact that the men are not paid by the municipality, but by the labour contractor who supplies them. Because of any shortcoming the municipality fines the contractor, but this does not affect the men, who continue their unruly conduct. What is wanted is that the men should be employed directly by the municipality, and that some legal enactment, similar to section 490 of the Penal Code, should render a refusal to work penal.

Sewage farms.

The sewage of several drains which formerly flowed to the beach or into the Cooum or canal, poisoning the air, is now lifted or led on to grass lands where it is deodorized by the sun. This system is pursued solely on sanitary grounds and would be continued even if the financial results were unfavourable, but a profit results from the sale of grass to private persons and of hay to the Body Guard and to the batteries at the Mount. The net profits in 1883 were Rs. 478.10.0 and during the 15 months were Rs. 744.4.7, and would have been higher had not the heavy rains caused damage.

Vaccination.

The expenditure on vaccination in 1883 was only Rs. 5,601.8.0, but in the 15 months it amounted to Rs. 14,105.12.5. The increase arose from the steps taken to facilitate vaccination in consequence of the epidemic of small-pox which prevailed from June 1883 to June 1884. Section 378 of Act I. of 1884 enabled byelaws to be passed making vaccination compulsory, and, accordingly, byelaws were framed and came into force on June 1st, 1884. In each division of the city there is a depôt where vaccination is performed without fee. In five of these depôts the vaccination is from the calf. The total number of cases vaccinated was 28,030 in 1882, 40,940 in 1883, and 66,507 in the 15 months. The per-centage of successful cases fell to 83·6, which is not quite satisfactory, but matters improved at the close of 1884 when Surgeon Davis and Deputy Inspector Jesudasen Pillay supervised the work, and strict supervision will no doubt maintain the improvement. One good feature in the work of the 15 months is that the number of infants vaccinated is close upon the number born. If this can be maintained there will be little cause to fear the next periodical outbreak of small-pox.

Vital statistics.

The birth-rate per 1,000 was 3·98, as compared with 41·2 in 1883, 42·7 in 1882, and 40·3 in 1881. The total number of births in the 15 months was 19,845, of which 415 were still-born, or almost 2·1 per cent. The per-centage of male and female births was 51·09 and 48·91.

In 1883 the number of deaths was 15,882, making a death-rate of 39·8 per 1,000. In 1884 the number of deaths was 20,123, or 50·48 per 1,000, and in the 15 months the number of deaths was 24,482, which is at the rate of 49·11 per 1,000 per annum. Of these 24,482 deaths, 4,074 were from small-pox and 1,358 from cholera. If the loss from these two causes be omitted the death-rate is only 38·2. The epidemic of small-pox was very severe in the opening months of 1884, the deaths in each month being January 798, February 1,111, March 1,238, April 524, May 211, June 78. Cholera decreased in these months, almost disappearing in June and July, only to break out with increased virulence in August, and in September there were no less than 573 deaths. It was still present up to the close of the 15 months under report.

The system of registration of deaths is not satisfactory, but it is difficult to suggest where improvement can be introduced. In Britain the cause of death is certified by a medical practitioner. In Madras the cause of death entered in the register is whatever cause is alleged by a relative, often ignorant of diseases and their classification. In some instances inquiries are made by the Health Officer or his subordinates, but this can be done only in a small number of the cases reported. One point may be mentioned in this connexion is that an extract from the municipal register is accepted as proof of death by the numerous societies that have recently sprung up over Madras. This does not concern the municipality, and the extract may be evidence that a death has taken place, because the register is checked with the returns from the burial and burning grounds, but it is not good evidence of the cause of death.

The deaths from different causes in 1883 and in the 15 months are here shown :—

	1883.	1884-5.
Small-pox	1,957	4,074
Measles	138	146
Fevers	3,470	4,863
Cholera	169	1,358
Bowel complaints	2,284	3,459
Other causes	7,864	10,582
	15,882	24,482

ABSTRACT OF REPORT OF THE MUNICIPAL COMMISSIONER FOR THE CITY OF BOMBAY FOR 1884-85.

(Mr. E. C. K. Olivant.)

In the Municipal Commissioner's Report for last year the reasons for laying a new 24″ main from Vehar to supply the northern and outlying districts of the city, and to carry the supply which could not be conveyed to the Bhandarwada Reservoir, were fully detailed. This main has now been laid as far as Kurla, where it is connected with the 32″ main to Bhandarwada, and the work of completing it between Vehar and Kurla, and of constructing filter beds at Vehar, is being pushed on. The connexion between the 24″ and 32″ mains at Kurla was only made on 6th April last, and the subject comes, therefore, more properly within the scope of next year's report; but I may mention here that the anticipated result was satisfactorily realized by the diminution and, indeed, almost total absence of the usual hot weather complaints of want of water in the Vehar districts. Mr. Braham reports that the 32″ main, owing, he supposes, to internal corrosion and incrustation, and the friction that is caused thereby, does not deliver as much water into the Bhandarwada Reservoir as it is theoretically capable of discharging, and he compares its actual capacity with that of a 30″ main. This is an additional reason in favour of the 24″ main direct from Vehar; and when this is completed there can be no doubt that the whole available supply from the Vehar Lake will be drawn off, increased as it is by the new catch-water channels which were completed in time to be brought into use before the monsoon of 1884, and which materially increased the quantity of water impounded. Supply.

The work of raising the Tulsi dams and constructing new catch-water channels is now practically completed, sufficiently so to impound and retain the water of this year's monsoon.

The Bhandarwada Waterworks are now completed. Mr. Braham accords considerable praise to all the contractors concerned, and their work was on the whole well done.

The filter beds at the Malabar Hill Reservoir were completed during the year under report, and have been in use during the whole year. The roofing of the reservoir is in progress. The filter beds will in a short time be completely roofed in. The water supplied to the Tulsi districts during the past hot weather was very much better than any that has ever been supplied to them before. When the roofing of the Malabar Hill Reservoir is completed and the new 24″ main laid from Vehar it will be safe to say that the quantity and the purity of the water distributed over the city are as ample and as perfect as it is possible to make them with the present sources of supply.

This leads me to the subject of the Tansa project, which cannot be passed by without some reference, though it can hardly be said to fall to any extent at all within the scope of the present report. The corporation sanctioned, on 27th November last, a grant of one lakh for the Tansa survey, and the work was begun by Mr. W. Clerke, Executive Engineer, whose valuable services were put at the disposal of the municipality by Government for the purpose on 27th February 1885. It is as yet premature to enter into any of the details of the project, but I may safely say that if it be carried out, the difficult question of water supply to the present city of Bombay and to any possible future Bombay will be set at rest finally and for ever.

The contractor for the supply of Deacon's patent differentiating waste water meters engaged to despatch an efficient superintendent to supervise the fixing of them and to train the staff required for working them. The superintendent arrived in Bombay at the end of December last. Eighty-six meters were fixed in the year under report. It is expected that the advantage derived in the prevention of waste will be great. In those towns where they have been adopted they are most highly spoken of, and when I was in England I had opportunities of judging of the excellent results obtained from them both in Liverpool and Glasgow. The duty of preventing the improper waste of water, especially when the quantity available is so restricted as it is in Bombay, and will be till the Tansa project is carried out, comes next in importance to the duty of securing an adequate supply, and the finances of the municipality will be very far from suffering from expenditure to that end.

The total number of water connexions has risen from 13,545 in 1883-84 to 13,909 in the year under report. The aggregate length of the mains examined by the Waste Prevention Staff was 34,945 feet, and leakage to the extent of 250,000 gallons per diem was discovered and checked. This staff is at present under the orders of the superintendent for fixing Deacon's meters.

Drainage.

Mr. Walton reports the final settlement with the contractors of all claims, &c., relating to the laying of the pipe sewers in the first portion of the drainage scheme. He also reports that from the absence of means for admitting the house sullage to these sewers they are practically useless. This subject, which has frequently been pressed on the attention of the corporation, was, at the end of the year under report, still being considered by a committee which was appointed to consider whether the necessary house pipes and fittings should be paid for by the municipality as at first determined, or by the house owners. It is very advisable that the construction of pipe sewers throughout the city should be pushed on, nor is there any reason why it should be delayed pending the settlement of the question whether the cost of the house connexions is to fall on the municipality or on the house owners. Whatever decision on this head be arrived at will not affect the necessity for the construction of pipe sewers. Until the system of branch sewers is complete the nuisance on the flats will not and cannot cease to exist. The new main sewers being designed only to carry sewage, to the exclusion of storm water, have necessarily to be disconnected during the rains from the old branch sewers which carry both. During the rains, therefore, the greater portion of the sewage of the city (the whole except what is put into the new system at the nightsoil depôts) finds its way into Back Bay and the harbour at the old outfalls, or into the old main drain. Whatever goes into the latter floods the flats more or less over the site of the future surface drainage reservoir. Were the system once completed, the old main drain would be used exclusively for carrying the storm waters, the whole of the sewage going by the new main drain to the pumping station, and the flats would cease to be a nuisance.

The completion of the Queen's Road intercepting sewer was noticed in para. 62 of the Municipal Commissioner's last report, though it fell within the year now being reported on. It will be remembered that a bonus was offered to the contractor at his suggestion if he would complete the work by the monsoon of 1884, instead of in February 1885, and though those terms were agreed to, and for the more speedy prosecution of the work the Queen's Road was opened up, much to the inconvenience of the public for a long distance, the contractor virtually threw up his contract on the 14th April 1884. The work was then undertaken departmentally, and so vigorously was it pushed on that by the 2nd July it was completed, though it involved the construction of no less than 5,180 feet of ovoid sewer. Great credit is due to Mr. Walton for the remarkable energy shown in the completion of this work; and he speaks very highly (and deservedly so) of several of his subordinates. By the construction of the Queen's Road intercepting sewer and the marine lines pipe sewer in continuation of it, which was also constructed by departmental agency during the past season, the nuisance arising from the outfall of sewage in Back Bay is over, except during the rains. In the monsoon, as has been already explained, the old outfalls have to be resumed, because the old branch sewers, carrying storm water as well as sewage, have then to be detached from the new Queen's Road intercepting sewer, which is designed only for sewage. For the pipe sewerage system connected with the Queen's Road drain the requisite surveys have been made, and plans and estimates prepared, and this subject will shortly be brought before the corporation. I should observe, however, that the abating of the Back Bay nuisance is also partly due to the construction of the pipe sewer from the Girgam nightsoil depôt to Queen's Road sewer, which was carried out during the year under report, and by means of which the outfall of sewage on to the foreshore of Back Bay, west of the level crossing, has been stopped.

The extension of the Clerk Road sewer from the Central Station to the Parel Road proceeded satisfactorily, and will be completed within the contract time. The progress of the DeLisle Road 18" pipe sewer was delayed by the rock blasting required, and the Arthur Road 15" pipe sewer, which is to be connected with it, has been retarded by the same cause, but it could in no case be used till the DeLisle Road sewer is ready for use, which Mr. Walton anticipated would be by 15th June.

The work of constructing ovoid sewers from the Crawford Market to the Mint and along the new Ripon Road has proceeded as rapidly as the difficulties caused by rock excavation in the former case, and by making terms with the owners of land in the

other would allow. The work of laying pipe sewers in the Agripada district has been kept well in hand, and Mr. Walton anticipates its completion within the contract time. The work of fixing the house sullage connections in Kamathipura was begun at the end of October last, and was carried on till the close of the year.

Turning to the subject of surface drainage, which is so intimately connected with the sewerage scheme that the two must always be considered together, the first thing to observe is that the greater portion of the Mahalakshmi storm-water reservoir has been excavated down to the required level of 77 T.H.D.; the banks have been constructed as far as the excavated material would allow; and the completion of the whole work is anticipated by the 31st December next. The diversion of the Tulsi pipe line has been effected. But as was observed in my annual report for last year, "it is very evident "that the channel which conveys the rain water to the reservoir should not also be a "carrier of sewage." But so it will continue to be until all the sources of sewage in the city are connected with the new main drains. Till this is done, the old branch sewers must be used. The connection of these with the new main sewers presents no difficulties during the fair weather, but as soon as the rains commence, they must be detached and reconnected with the old system. The old main drain, therefore, during the rains continues to pour sewage as well as storm water over the Flats, that is, over what will be the surface drainage reservoir, and thus at present there can be no abatement of the nuisance on this part of the Flats.

The Gowalia Tank, Tardeo, and Arthur Road storm-water drain has been completed, and the flooding of the low-lying parts of the city about Khetwadi has been materially relieved. The storm-water drain from Bellasis Bridge to the point where Bellasis Junction Road meets Parel Road has been completed with the side entrances and water entrances thereto. The section from Bellasis Junction Road to Jail Road is now in progress; it is rendered difficult by the small space to spare between the tramway line and the gas main. The surface drainage of Kamathipura has been completed. Mr. Walton draws attention to the necessity of providing an improved outlet for the storm-water of the Parel and Chinchpokli neighbourhoods.

The discharge of the night-soil that used to be pumped into the harbour at Carnac Bandar into the new main sewer at the same place is one of the chief features of the year's administration. The pumping arrangements have been so designed by Mr. Walton as to cause a minimum of offence on the spot. The whole of this night-soil is now carried away to the Love Grove Pumping Station, where the engines have worked very well throughout the year, though neither so well nor so economically as they will work when the improvements and additions which are being made are completed. The chief of these is an extra condensing tank which has been rendered necessary since the number of engines has been increased from two to four. The total quantity of sewage lifted during the year was 11,883,274-8 tons, at an expenditure on coal of Rs. 26,503-0-6, which was well within the Budget allowance. I may mention here, though it is properly a subject for next year's report, that the construction of a chamber within which the offensive matters raised by the shred-lifter may be incinerated is being pushed on, and will soon be complete.

LIBRARY OF THE BOMBAY BRANCH OF THE ROYAL ASIATIC SOCIETY

ABSTRACT OF REPORT OF THE HEALTH OFFICER OF BOMBAY FOR 1884.

(D. C. Davidson, Acting Health Officer.)

It is, I think, very desirable that the present state of the building sections of the Municipal Act and the condition of buildings intended for human habitation, which are being daily erected in Bombay, should be prominently brought to notice. The Municipal Act, as it at present exists, is so defective as to afford little or no protection to the public against the erection of most insanitary dwelling-houses, which are directly injurious and dangerous to the health and lives of people, who are compelled by circumstances to occupy them, and are potent factors in bringing about and augmenting epidemics which give rise to much misery and expense, and by causing the imposition of quarantine seriously to interfere with trade. So long as the building sections of the Municipal Act remain as they now are, dwellings of the most unwholesome description—direct causes of disease and pestilence—will from year to year be built with, at all events, the tacit sanction of the municipality. Very large sums of money are being expended on sanitary improvements, and the importance of these improvements it would be difficult to over-estimate; but surely when money is being thus expended for improving the sanitary condition of the city, the minimising of epidemics and reduction of the death-rate, it is not too much to ask that unwholesome buildings, opposed in their construction to the most rudimentary principles of sanitation, factors in the production of epidemics, direct causes, indeed hot-beds of disease, should not only not be reproduced, but erected *de novo* and with impunity. By a large expenditure of money on the one hand certain sanitary advantages are procured, which are, in a measure, counterbalanced by defective legislation on the other.

Plans for almost every description of insanitary buildings are submitted. A not unfrequent form of plan is that for a chawl three or four rooms deep with, perhaps, gullies only three or four feet wide on each side. The centre rooms of such a building have no direct communication with the external air; they are dark, unwholesome dens, into which the light of day never penetrates, and which must of necessity breed disease and pestilence. This is only one instance of the many unwholesome description of buildings being erected in Bombay. Much has been done during the past and previous years in regard to widening roads and streets, and the benefit to the health of the city, which, as a general rule, is the result, is too evident to need comment, and yet it is not unnecessary to inquire whether "set-backs" to improve the line or widen any street are an unmixed good. A man intends to rebuild his house, in the rear of which 10 or 12 feet of open space had been left for ventilation. On submitting plans he is perhaps called upon by the municipality to set back his house 10 feet. What is the consequence? He does not diminish the size of the house and still leave an open breathing space in the rear of 10 feet; he literally sets his house back 10 feet, and builds on the open space which had originally been left for ventilation, thus shutting out light and air from the rear portion of his dwelling, and rendering the back rooms dark, unwholesome dens, into which light and pure air never enter.* It is not only useless, but detrimental to enlarge the breathing space of the streets at the expense of the ventilation of the houses. It is not in the streets that people materially suffer

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* *Note.*—If this means that because house-ventilation is very insufficiently attended to in the absence of much needed byelaws, therefore street improvement and the provision of additional air-space outside the house should be stopped, and this may be the inference drawn,—I must express my dissent from the Acting Health Officer's opinion. In both respects and in other elementary sanitary requirements improvement must be steadily sought for, but there is no reason in Bombay more than elsewhere that one improvement should be made at the expense of another.—E. C. K. O.

from the effects of imperfect ventilation; it is in their own homes, and anything which interferes with the ventilation of human habitations is in the highest degree detrimental to the public health. The most perfect drainage, the purest water-supply, and the widest streets will not prevent a large amount of disease and a heavy death-rate, especially from affections of the respiratory system, while house sanitation is so woefully neglected as it is in Bombay at the present time. A privy is occasionally built inside a house and overhanging a well; on another occasion a similar structure is built within three feet of a well of drinking water, and a drain is constructed to carry sewage within a foot-and-a-half of the same well; a privy is built or rebuilt underneath inhabited rooms; and yet, notwithstanding the self-evident danger to the public health arising from this, and that such arrangements are opposed to the most rudimentary principles of sanitation, so accustomed have people in Bombay become to them that I have been gravely informed by otherwise fairly intelligent men that such contrivances are "unobjectionable." In such cases it is hopeless to argue and useless to make comments; it is necessary only to state plain facts which any intelligent man ought to be able to comprehend and understand how his own health and life and the health and lives of his fellow-citizens may be sacrificed to a disregard of the first principles of house sanitation.

The question as to the disposal of town sweepings is still under consideration, the refuse in the meantime being deposited on the flats, which proceeding ought to be discontinued, on sanitary grounds, as quickly as possible; but apart from all such considerations, a new method of disposing of the garbage will require to be adopted without delay, as the ground available on the Flats is now nearly filled in, and unless early steps are taken in regard to this important matter, the corporation will find themselves involved in a grave sanitary difficulty. I am still of opinion that the only satisfactory method of disposing of the refuse which can be adopted is to remove it to Coorla, where there is a large tract of waste land belonging to the municipality, practically unlimited in extent for this purpose, which could be reclaimed and would form a valuable estate and from which a large rental could be derived. Instead of trusting to the railway a tramway ought, I think, to be constructed, but this has already been strongly recommended by me in former reports.

In 1883 I drew attention to the condition of milch cattle stables in Bombay in the following terms:—"The nuisance arising from the rapidly growing number of buffalo "stables in Bombay must, sooner or later, force itself upon the notice of the municipality, and they will be called upon to provide a practical remedy. Were places "set apart for this purpose outside the city, and no new stables, save under very "special conditions, licensed in the town itself, the difficulty would in a measure "be solved.

"Complaints are constantly received regarding the nuisance arising from those "places, and I would mention two in particular, where the stables are in a most "insanitary condition, viz., the Downi and those on Mody Bay belonging to the Port "Trust, which during the rains especially are most injurious to the health of the "neighbourhood."

I am glad to be able to report that the milch cattle have, owing to the persistent efforts of this Department, been removed from the Port Trust Property at Mody Bay, but the "Downi" still continues in an insanitary state. The remedy for the unwholesome condition of buffalo stables is entirely in the hands of the corporation. Proper stables ought to be built by the Municipality on some suitable position or positions on the outskirts of the city, and when that has been done, there can be no hesitation in taking rigorous and persistent action against the owners of all insanitary cattle stables in Bombay, and causing them to be vacated. At the present time, when cattle are driven out of any one stable, there is often no other in which they can be accommodated, and they frequently are, under such circumstances, located in quarters much more objectionable than those from which they had been expelled. Again action is taken, and the poor animals are driven elsewhere. No doubt the owners are punished as well as the buffaloes, but no permanent sanitary good is accomplished. The Health Officer is in the position of the London policeman, who has orders to make the street Arabs "move on," but has received no instructions from the municipal authorities as to where they are to go.

Every public milch cattle stable in Bombay should be under the entire control of the municipality, and cleansed, flushed, and kept in proper order by their servants at the expense of the owners. The question of a pure milk supply is of such vast importance to the public health that no effort or expense should be spared to secure it.

The question of some system of medical relief for the poor at their own homes—something similar to the union medical system in England—is one well worthy of consideration. This has been previously brought to notice on several occasions, and, amongst other, by Drs. Weir and Blanc. At the present time the very poor receive no medical relief at their own houses as a part of any recognised system; unless they are able to visit one of the various hospitals or dispensaries, they either die untended or recover as best they may. It is therefore, I think, right, both in the interests of the public health as well as from motives of humanity, that the corporation should organize some system by which the benefit of medical science may be made available in the homes of the poor.

In almost every large town in England, in addition to Union or Poor Law Medical Officers, dispensaries exist, in connection with which medical men are appointed to visit poor patients at their own houses, while the smallest country village possesses a union Medical Officer, and yet this large city of Bombay, with three-quarter of a million of inhabitants, is totally unprovided with any system of home medical relief for the suffering poor.

I would recommend that a medical practitioner be appointed to each ward of the city on a salary of one hundred rupees per mensem, with an allowance for medicines. During epidemics and outbreaks of cholera special medical officers have, during the last two years, been appointed to attend to cholera-stricken people at their own houses. The system was introduced by Dr. Weir, when he was acting as Municipal Commissioner in May 1883, and has worked well, but it will, of course, be understood that it was never intended that this system would enable us to dispense with properly appointed cholera hospitals. The following report was furnished by me at the request of the Town Council in regard to this subject:—

"To THE MUNICIPAL COMMISSIONER.

"SIR,—I have the honour to acknowledge the receipt of your endorsement No. 11,294 of 1884–85, and to state, in reply, that in my opinion the system of appointing special medical officers for cholera duty worked well, and I would recommend that their services should be again solicited in the event of another epidemic of that disease. I do not, however, consider that the treatment of the very poor at their own homes by medical officers at all so satisfactory as would be the treatment of such cases by the same medical men in well-appointed hospitals. There is in many cases an entire absence of that essential of all treatment, viz., good nursing and proper nourishment adapted to the disease and the condition of the patients. Many distressing cases of this description were brought to my notice during the late epidemic, and it was for this and other reasons that I so frequently urged the necessity of providing properly-appointed cholera hospitals within easy reach of cholera-stricken people. If the father and mother are ill, or have died of cholera, there is often no one left to attend upon the sick children, and neighbours and friends not unfrequently decline to hold any communication with them. Under such circumstances, there would be no resource but to remove them to a hospital, when one is available, but if they have to be carried a long distance, as, for instance, from Mahim to Grant Road, this would be impracticable, as, were the patients very ill, they would probably die on the way or shortly after admission. Even in less extreme cases, when a mother has two or more sick children to attend upon, and perhaps the father as well, she cannot devote to them that amount of attention which is necessary to afford them the ordinary chances of recovery, and neighbours are not anxious to render assistance in such cases.

"From the experience I have had I am led to believe that cholera hospitals afford to the cholera-stricken poor by far the best chances of recovery.

"*b.* I think that the measures adopted by the Health Department lessened in a very material degree both the severity and extent of the epidemic.

"*c.* I am not aware of there having occurred any inconvenience to the patients or others from the system adopted. So far as I could observe, the kindness and tact displayed by all the medical officers in dealing with the sick poor precluded any such inconvenience arising."

It is a matter for congratulation that there is now every probability of an increased water-supply being made available, and that some of the initiatory steps have already been taken in regard to the Tansa scheme. As a sanitary officer the want, and the effect of the want, of a proper water-supply are constantly being brought to my notice. An outbreak of cholera rarely occurs, but there is at least suspicion in connexion with the water. This was in 1883 very marked at Mahim and other outlying districts which

are imperfectly supplied. The present intermittent supply is quite insufficient for the wants of the people, and there can be no doubt that it is eked out from wells, the purity of which is often more than doubtful, and the surroundings in many cases of the most insanitary description. If a proper continuous supply were made available, few people would resort to wells, and the result would, I am persuaded, be marked by a decided improvement in the public health. There is no greater sanitary want than this, and no greater benefit could be conferred upon the city than a plentiful supply of pure water.

The registration of deaths in this city is now, and always has been in an unsatisfactory condition. Every effort is made by the health officer to obtain correct information of the causes of death; and regarding cholera, the information obtained, owing to the efforts of the Health Department, is, I think, accurate; but the system which prevails in England, of all medical men furnishing a certificate of the death of those whom they have attended in their last illness, is not adopted here. I am endeavouring to introduce this system. In every case in which the deceased person had been attended by a medical man, the medical attendant will now be asked for a certificate as to the cause of death. Those cases in which a certificate is granted will be entered in the Registrar's returns as "certified," and all others as "uncertified," so that the accuracy or otherwise of our mortuary returns will, in a great measure, in future, depend upon the co-operation of the medical profession of Bombay, and I venture to hope that they will be willing to assist in such a work of public utility and medical interest. As medical advice is more generally sought by all classes, our statistics will prove more and more accurate; and should the proposal, elsewhere recommended, of establishing some system of poor law medical relief be adopted, a great impetus would be given to this important work.*

Vital statistics.

Exclusive of still-born, 22,542 deaths were registered, a mortality 988 less than in the preceding year, but 637 more than the mean of the previous five years. The death-rate, estimating the increase of population, is equal to 27·29 per 1,000 of population. The mortality, as in the previous year, consisted of a low male and high female death-rate; the male mortality was only 25·29 and the female 34·96 per 1,000 of population.

In 1883 the male mortality was 26·62 and the female 36·16 per 1,000 of population. The reduction was, therefore, more than one per 1,000 of population in both sexes since 1883.

Examining the deaths according to places of birth, we observe that 11,106 were born in Bombay, being 318 less than in the previous year, and 11,181 were born elsewhere, and that the place of birth of 255 could not be ascertained.

Examining the population by classes, it will be seen that the proportion of male to female deaths is higher in the immigrating population. The death-rate of females amongst the Jains during the year under report is higher than that of males by 65·2 per 1,000 of population of each sex, and there is reason to believe that it is in a measure owing to the migrating tendency the males of that community possess for trading. On the other hand, in the permanent and non-fluctuating class of population—the Parsees—the death-rate of females as compared with that of males is not so high, being in the proportion of 24·6 to 21·1 per 1,000 of population of sexes.

If we refer to age periods, we find that the fatality of females between 12 and 40 years of age is higher than that of males, and this is, I believe, partly due to diseases and conditions associated with child-birth. The mortality is further enhanced by additional causes, such as employment in cotton mills and wool-cleaning factories, occupations which are injurious to female life.

The rate of mortality from phthisis is higher amongst females than males, and this may be accounted for in a measure by the fact that women of certain castes remain almost entirely, or to a great extent, in their houses without taking exercise in the open air. The more or less vitiated atmosphere which they thus constantly inhale would prove a potent factor in the production of phthisis, more especially when the ill-ventilated condition of a large number of human habitations in Bombay is taken into consideration. In other castes the impure air too often breathed in factories of various descriptions, where large numbers of women are employed, would, to a certain extent, account for the relative higher mortality.

* The section of the Municipal Act relating to this matter is, for all practical purposes, null and void, there being no penalty for non-compliance.—*D. C. D.*

The mortality, arranged according to groups of important death causes, is shown in the table below. There is a reduction in the mortality from small-pox, cholera, phthisis, nervous system, diarrhœa, and dysentery against last year.

Causes of Death.	Number of Deaths.	Rate per 1,000 of Population.	Remarks.
Small-pox	112	·13	Annual increment of population is calculated.
Measles	456	·55	
Fever	6,830	8·27	
Cholera	576	·70	
Phthisis	3,091	3·74	
Diseases of nervous system	2,422	2·93	
Do. respiratory do.	3,744	4·53	
Diarrhœa	1,084	1·31	
Dysentery	635	·77	
Accidents	328	·40	
All other causes except still-born	3,267	3·96	
Total	22,542	27·29	

The infant mortality under five years of age is less than the previous year by 337 deaths. 6,393 children under one year of age died against 6,581. The percentage of deaths in 1884 under one year to total deaths was 28·36, and to that of births registered was 43·67.

Kamathipura still maintains its high rate of mortality amongst children as well as adults. This year it presents a higher death-rate amongst children than any other section of the city with the exception of 1st Nagpada. It will be remembered that it is in the Kamathipura section that house connections have been tried, but I think sufficient time has not yet elapsed for an opinion to be expressed whether the new system of connexions will have any decided effect upon the health and death-rate of the locality.

The lowest mortality is observed amongst Europeans (19·23), but the remark made on this point in the last annual report applies equally to the year under review.* The European mortality is less than the Parsee mortality by 3·63 per 1,000 of population. The Eurasian mortality (37·67) has this year fallen by 12·84 per 1,000 of population, the death-rate in 1883 being 50·51.

Small-pox. The mortality from small-pox has fallen to 112 against 1,461 in 1883, and 343 less than the mean of the previous five years. This is the smallest number of deaths, with the exception of 1881 and 1882, in any one year registered since 1849. The highest mortality was registered in Dhobie Talao ·45, Worlee ·40, and Kamathipura ·35 per 1,000 of population.

Measles. From measles 456 deaths were reported during the year; this shows an increase of 137 deaths over last year. During the first and second quarters of the year 338 deaths were registered. In 1st Nagpada, Upper Colaba and Dongri the death-rate was higher.

Cholera. From cholera 734 cases were reported during the year, of which 576 proved fatal; the death-rate was therefore equal to 0·70 per 1,000 of population. Of the total number of cases 97 persons were born in Bombay, and 637 outside of Bombay; of the cases born in Bombay 81 died, and of those born elsewhere 495 died.

Of the cases reported to have suffered from cholera 569 used Vehar or Tulsi, 89 well water, and in 76 cases it could not be ascertained which water was consumed.

* Examining the mortality according to classes, we find that, of the principal races occupying this city, the lowest mortality is registered amongst Europeans, but this is, no doubt, largely due to the fact that sick Europeans, when practicable, leave Bombay as quickly as possible and die or recover in England or elsewhere, thus reducing the mortality far below what it would be were they placed under the same conditions as other communities.—*Health Officer's Annual Report for* 1883-84.

	Attacked.	Died.
Vehar and Tulsi water drinkers	569	444
Well water drinkers	89	71
Not known	76	61
Total	734	576

The mortality from cholera is 451 less than in the last year, and 152 more than the mean of the preceding five years.

Examining the distribution of the mortality from cholera over the city by sections, we observe that in two sections no deaths from cholera were registered, viz., Upper Colaba and Southern Fort. The highest mortality was registered in Chaupati (2·09), Girgam (1·97), Esplanade (1·91), Mahim (1·79), Dhobi Talao (1·67), and Fanaswadi (1·11).

According to classes the highest death-rate from cholera was amongst the Native Christians (2·24).

Fevers. The deaths from fevers were 6,830 in 1884, 927 more than the last year and 80 more than the average of the preceding five years; 5,307 deaths were referred to remittent fever, being 868 more than the last year; 1,223 to simple continued fever, 282 to ague, and 18 to enteric fever. The highest mortality was observed in Sewri (16·20) and Parell (14·70) sections. In Sewri a greater number of deaths from fever was registered in September, October, and November than the other months of the year.

Other diseases. 3,091 deaths were referred to phthisis, 53 less than in 1883, and 338 more than the mean of the preceding five years. The death-rate from phthisis is higher in Chukla and 2nd Nagpada than the last year. Contrasted with 1883 we observe a diminution in the mortality from phthisis in Khara Talao, a district of a high phthisical mortality, registered in the preceding years, and it now occupies a third place of high mortality. In Chukla, 2nd Nagpada, Khara Talao, Bhuleshwar, Kamathipura, and Oomerkhadi the ventilation of houses is in a large number of cases very defective, and unfortunately not only does this apply to dwellings which have existed for years, but also to many new buildings. I have elsewhere alluded to the absolute necessity there is, in the interests of the public health, of amending the building sections of the Municipal Act. It is universally acknowledged that defective ventilation is a potent cause of consumption, and unless we are enabled to deal with house sanitation in a more effectual manner than at present, I fear there is little hope of reducing the death-rate from phthisis. This question is second to none in the important bearing it has upon the public health, and I consider it my duty to avail myself of every opportunity of bringing it to notice, and earnestly urging that something may be done to remedy the crying evils which at present exist.

Examining the mortality from all causes, there is an increase of death-rate over 1883, principally in 1st Nagpada by 3·52, in Chukla by 3·26, Sewri 2·88, and Mahalaxmi 2·57 per 1,000 of population.

To diseases of the respiratory system 3,744 deaths were referred, being 350 more than the last year, and 835 more than the average of the previous five years; 2,186 were ascribed to bronchitis, being 358 more than the last year and 586 more than the mean of the past five years; to pneumonia 1,188 were referred, 29 more than the last year and 175 more than the average of the past five years.

From diseases of the digestive system 2,288 deaths were registered, being 83 less than the last year, but 243 more than the mean of the previous five years; 1,021, being 79 less than the last year and four less than the average of the previous five years, were referred to diarrhœa; and 635, being 11 less than the past year and 222 less than the mean of the preceding five years, to dysentery; to all other diseases of the digestive system 572 deaths were ascribed, being 7 more than the last year and 17 less than the average of the past five years.

From diseases of the nervous system 2,422 deaths were registered against 2,849 of the last year; 1,980 deaths were referred to infantile convulsions.

Births. During the year 14,637 living births and 1,479 still-born were registered, being 545 less than the last year; 7,634 of the children born living were males and 7,003 females. The proportion of male to female births was 109 to 100. The birth-rate is equal to

17·72 per 1,000 of population. This year the birth registration in certain castes has improved. For instance, amongst Jews the birth-rate has risen from 29·50 to 29·81, and of the Europeans from 17·51 to 17·79; 8 births were registered amongst the Negro Africans against 2 in the previous year.

The system of birth registration is one requiring attention and reform. It is at present in an unsatisfactory state. The principal information is obtained from peons sent round to the different houses by this Department. These peons, or Registration Karkuns as they are termed, are under the general supervision of the Ward Inspectors, who have not sufficient time to devote to this portion of their duties. I think it is, therefore, very desirable that a special officer should be appointed to superintend the Karkuns on, say, a salary of 50 or 60 rupees per mensem. It will also be necessary to enforce the sections of the Municipal Act by which parents and guardians are required to give information to the Registrars of the districts in which they live.

APPENDIX.

No. 1.

MEMORANDUM of the ARMY SANITARY COMMISSION on the REPORT of the SANITARY COMMISSIONER with the GOVERNMENT of INDIA for 1884.

1. In our Memorandum on the Sanitary Commissioner's Report of last year, we noticed the fact that it was the twentieth and last of the annual Reports of Dr. Cuningham, who for that long term had filled the office of Sanitary Commissioner with the Government of India, much to the advantage of sanitary improvement. The present Report has been prepared by his successor, Surgeon-General Dr. B. Simpson, and as the same arrangement of subjects and material has been followed in the present as in preceding Reports, we shall proceed to discuss its contents in the usual order.

2. The following table gives an abstract of the inefficiency statistics for the whole European Army in India since the year 1870:—

Years.	Strength.	Ratios per 1,000 Strength.				
		Admissions.	Daily Sick.	Deaths.	Invalids.	Total Loss.
1870-79	527,416	1,475	60	19·84	48	62
1878	56,475	1,651	68	21·46	45	66
1879*	49,582	1,977	78	24·28	49‡	73‡
1880*	51,796	1,789	74	24·35	25‡	51‡
1881†	58,728	1,605	70	16·86	38	55
1882	57,269	1,445	65	12·07	33‡	45
1883	55,525	1,336	63	10·88	33	44
1884	54,996	1,513	67	13·56	32	44

* Excluding troops serving in Afghanistan. † Including troops in Afghanistan.
‡ Calculated on the strength obtained from annual returns.

3. It will be seen from this table that the year 1883 presented as a whole the most favourable aspect of Army health in India; and in our remarks on the data we pointed out the necessity of securing the improvement in health which had been attained, and that an outbreak of epidemic disease would easily alter the data. It hence follows that one of the problems presented by these statistics is the reason why the ratios of admissions, daily sick, and deaths have increased, and to arrive at this information we must first ascertain where the increase in these inefficiency rates has taken place, and, if possible, what has been the cause. A reference to the table shows that the increases of 1884 have been in the admissions, daily sick, and death-rates, and we shall next show to what extent these took place in each of the European Presidency Armies.

4. The data for the Bengal Army were as follows:—

	Ratios per 1,000 Strength.		
	Admissions.	Daily Sick.	Deaths.
1883	1,463	66	11·21
1884	1,682	70	11·68
Increase in 1884	219	4	·47

The increase of 0·47 in the death-rate in the Bengal Army was mainly due to 0·40 from cholera over the cholera-rate of 1883.

5. The corresponding data for the Madras European Army stood as follows:—

	Ratios per 1,000 Strength.		
	Admissions.	Daily Sick.	Deaths.
1883	1,013	59	10·19
1884	1,109	57	8·53
Plus and minus 1884	+ 96	− 2	− 1·66

It is clear that the Madras Army added only 96 per 1,000 to the admissions, while its daily sick and death rates were under those of the preceding year. The cholera death-rate in this Army, which was 0·95 in 1883, was 0·93 in 1884.

6. The Bombay Army yielded the following ratios:—

	Ratios per 1,000 Strength.		
	Admissions.	Daily Sick.	Deaths.
1883	1,249	57	10·50
1884	1,455	65	19·39
Increase in 1884	206	8	8·89

Of the increased death-rate, 4·03 was due to cholera, which in 1883 showed a ratio of 0·82 and in 1884 one of 4·85 per 1,000.

It is evident from these data that the causes of increased mortality and inefficiency are to be sought mainly in the Bombay Army, and that it will be necessary to deal with these separately before the real death-rate for the whole European Indian Army comparable with the rate of 1883 can be arrived at.

7. For this purpose we shall abstract the facts given in Dr. Stephen's tables at the end of the Report under review, and as the question at issue relates to the sanitary condition and improvement of Bombay stations, we shall deal with the station death-rates.

At 19 stations in Bombay, including Deolali depot, there was an average strength in 1884 of 8,932 men, among whom there 98 deaths, or 10·97 per 1,000. But there were other two bodies of men, of whom 1,079 were at Quetta, in Southern Afghanistan, and 1,088 were marching in the same country. At Quetta there were 41 deaths in 1884, or a ratio of 38 per 1,000. Among the marching troops there were in four months 58 deaths, or 53·31 per 1,000. By adding these data, the death-rate is raised for the whole Bombay Army to 13·44 per 1,000, and with a few deaths among troops on the march in Bombay Presidency, we arrive at the whole year's increase.

8. It is quite true, statistically, that the Bombay Army shows a considerable increase of mortality in 1884. But when dealing with such questions for practical sanitary purposes, it is necessary to bring the facts home to their proper causes, and the result in the present case is that the sanitary problem in Southern Afghanistan is another thing than it is in Bombay. We have endeavoured in our Memorandum on the Bombay Army Report for 1884 to show wherein this difference lies, and the treatment it requires.

9. Acting on this view of the case, we may deduct the Afghanistan strength and deaths from the Indian aggregate, and we shall have a strength of 52,829 men, yielding 592 deaths, or in the ratio of 11·2 per 1,000, or 0·32 in excess of the rate of 1883. We shall show afterwards the cause of this increase, and we may contrast this estimate with the results for an average strength of 1,441 men in Afghanistan, the annual death-rate among whom, as given by Dr. Stephen, was 68·70 per 1,000.

10. We shall next give the data for each Presidency army separately:—

Army of Bengal.

Period.	Average Strength.	Ratios per 1,000.				
		Admissions.	Daily Sick.	Deaths.	Invalids.	Total Loss.
1870–79	368,431	1,522	61	21·00	41	62
1878	35,536	1,675	68	21·63	40	62
1879*	29,255	2,108	82	29·82	47†	77†
1880*	31,583	1,873	75	27·73	22†	50†
1881*	35,901	1,729	72	17·65	37†	54†
1882	35,164	1,579	69	13·17	35	48
1883	34,972	1,463	66	11·23	31	42
1884	33,486	1,652	70	14·68	32	44

* Excluding troops in Afghanistan. † Including troops in Afghanistan.

The death-rate among Bengal troops was slightly raised in 1884, as were also the other sources of inefficiency. The difference was not great, but quite sufficient to call for watchfulness. The increase in 1884 amounted to 0·47 per 1,000, and of this amount 0·40 was due to a rise in the death-rate from cholera from 0·94 per 1,000 in 1883 to 1·34 in 1884.

11. *Army of Madras* :—

Period.	Average Strength.	Ratio per 1,000.				
		Admissions.	Daily Sick.	Deaths.	Invaliding.	Total Loss.
1870–79	10,896	1,264	59	17·69	40	57
1878	10,815	1,392	66	21·82	48	70
1879	10,444	1,428	68	16·56	45	62
1880	10,310	1,366	64	10·18	20	30
1881	10,391	1,160	60	10·97	28	39
1882	10,020	1,058	57	10·25	24	34
1883	10,498	1,013	52	10·19	33	43
1884	10,785	1,109	57	8·53	32	40

The decrease of 1·66 in the death-rate shown by the table was not due to cholera, although there was a slight reduction from 0·95 per 1,000 to 0·93. The reduction took place in other death causes outside cholera, and these yielded a death-rate of 7·60 in 1884 against 9·24 per 1,000 in 1883. On the whole the result was not unsatisfactory.

12. *Army of Bombay* :—

Years.	Average Strength.	Ratios per 1,000.				
		Admissions.	Daily Sick.	Deaths.	Invaliding.	Total Loss.
1870–79	103,587	1,533	57	13·27	43	58
1878	9,825	1,848	67	20·46	58	78
1879	9,883	2,173	78	15·78	60	76
1880	9,903	2,150	78	30·90	49	80
1881*	9,895	1,784	72	18·44	53†	67†
1882	11,085	1,485	61	10·37	36	46
1883	19,948	1,249	57	10·50	38	48
1884	10,725	1,455	65	19·39	31	51

* Excluding troops in Afghanistan. † Including troops in Afghanistan.

We have already stated that the death-rate in the Bombay army in 1884, included the rate in Southern Afghanistan, by deducting which the rate for Bombay stations becomes 10·97 per 1,000, showing an increase of 0·47 per 1,000 on the rate of 1883, but otherwise the year's result was likewise not unsatisfactory.

13. We shall next give the death-rates for the same periods for different groups of Bengal stations :—

Periods.	Death-rates per 1,000.						
	Bengal Proper.	Gangetic Provinces and Oudh.	Meerut and Rohilkund.	Agra and Central India.	Punjab.	Hill Stations.	Bengal Presidency.
1860–69	29·57	28·59	26·61	38·48	25·24	14·78	29·98
1870–79*	14·48	20·06	18·31	18·41	20·71	12·23	21·00†
1880*	16·03	22·32	22·98	15·67	36·44	20·75	27·73
1881*	12·02	15·94	17·81	10·11	23·44	9·97	17·05
1882	11·19	22·61	8·86	10·51	12·12	8·65	13·17
1883	9·10	12·04	10·56	14·27	9·47	6·83	12·21
1884	10·07	14·72	17·01	15·58	9·75	5·91	11·68

* Excluding troops in Afghanistan and on the march.
† Including troops in Afghanistan and on the march.

The contrast between the death-rates in the earlier and later years of the series given in these groups is very remarkable. But there is evidence in the inconstancy of the more recent death-ratios to show the need of vigilance in looking after the sanitary condition of the stations, especially those in Meerut and Rohilkund.

14. We have omitted the admission-ratios in the comparisons on account of the large and variable admission-rate from venereal diseases at different stations. It will be sufficient on this subject to state the admission-rate for each of the three armies :—

	Admissions per 1,000 from Venereal Diseases in 1884.
Bengal	281
Madras	307
Bombay	292

15. We shall next give a brief account of the chief causes of inefficiency in the course of the year:—

Diseases.	Ratio per 1,000.							
	Bengal.		Madras.		Bombay.		Army of India.	
	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.
Cholera	2·1	1·34	1·1	0·98	6·3	4·85	2·7	1·95
Small pox	1·5	0·18	1·8	0·09	0·7	0·09	1·4	0·14
Enteric fever	12·6	3·81	11·4	1·67	9·1	2·05	11·7	2·74
Intermittent fever	623·2	—	129·7	—	419·7	0·09	486·8	0·02
Remittent fever	59·6	0·36	36·3	—	84·7	2·05	59·9	0·62
Continued fever								
Apoplexy and sunstroke	3·2	1·04	1·7	0·84	4·0	1·49	3·1	1·09
Delirium tremens, &c.	9·9	0·21	3·8	0·09	9·0	0·09	8·2	0·16
Dysentery	21·6	0·18	55·6	0·37	26·5	1·03	29·2	0·38
Diarrhœa	51·3	0·03	42·4	0·19	53·2	0·18	49·9	0·09
Hepatitis	26·0	0·84	36·2	2·04	18·2	1·03	26·5	1·11
Spleen disease	5·1	0·06	0·5	—	2·6	—	3·7	0·04
Respiratory diseases	79·2	0·72	45·8	0·09	82·1	1·40	73·2	0·78
Heart diseases	—	0·18	—	0·09	—	0·37	—	0·20
Phthisis pulmonalis	7·3	0·93	5·2	0·28	8·1	0·75	7·0	0·76
Rheumatism, &c.	50·8	—	45·7	—	40·3	—	47·9	—
Violent deaths, wounds, &c., accidents, suicides	124·3	1·23	114·0	1·20	114·6	2·24	120·4	1·42

This table shows the ratios of disease admissions and deaths, but it scarcely enables us to form an estimate of the work actually done by the Indian Army medical staff in 1884. There were received into hospital in the course of the year 83,230 patients, of whom 30,787 were suffering from fevers, and 16,166 from venereal diseases, and there were 6,619 wounds and accidents treated.

16. In previous Memoranda we have shown the causes of decreased or increased mortality from the chief diseases during past years, and we shall here continue the data for each army, beginning with cholera:—

	Death-rates per 1,000.		
	Bengal.	Madras.	Bombay.
1860–69	9·24	—	—
1870–79	4·18*	1·68	1·53
1880	4·84†	·10	—
1881	3·23*	1·73	·30
1882	1·26	·82	·63
1883	·94	·95	·82
1884	1·34	·93	4·85

* 24 per cent. of this rate took place in Afghanistan in 1879. † Excluding troops in Afghanistan.

There has been a great reduction in cholera death-rates since 1860, especially in Bengal; but as already has been stated, the great increase in the Bombay Army in 1884 was due, not to Bombay, but to Southern Afghanistan, where out of a total loss from cholera by 52 deaths 39 took place, leaving 13 deaths for the Bombay stations.

17. A further analysis of the data for Bengal Presidency will enable us to trace more clearly the places where reductions in cholera mortality have taken place, as follows:—

Periods.	Deaths from Cholera per 1,000.					
	Bengal.	Gangetic Provinces.	Meerut and Rohilkund.	Agra and Central India.	Punjab.	Hill Stations.
1860–69	6·26	8·12	6·55	15·94	6·39	1·80
1870–79	·85	4·24	2·06	3·22	3·95	1·60
1884	1·06	3·17	4·19	1·75	—	—

This abstract shows a great reduction of losses from cholera since 1860, but it contains warnings also against relaxation of efforts to root out the local predisposing causes of this disease. Moreover, the deaths registered from cholera in 1884 among the civil population in the same divisions were fewer than those among troops in proportion to their numbers, but the registration cannot altogether be relied on in such comparisons. All that can be said is that there was a severe epidemic of cholera over the north of India, and that in certain divisions it showed a tendency to increase at the stations,

showing that greater activity in dealing with its local predisposing causes is required. Of the stations, Meerut was the chief offender, and yielded 28 cases of cholera, of which 13 proved fatal.

18. Cholera, besides being a disease attacking localities, is also an epidemic, but the chief death cause was not cholera, but enteric fever, which is a more purely local disease than cholera.

The whole Indian Army, including troops in Southern Afghanistan, yielded 167 cholera deaths, but the same troops yielded 151 deaths from enteric fever, and there is no doubt that, statistically, the deaths from enteric fever have been increasing, as this abstract appears to show:—

	1870-79. Deaths per 1,000.			1884. Deaths per 1,000.		
	Enteric Fever.	Other Fevers.	Total.	Enteric Fever.	Other Fevers.	Total.
Army of India	2·08	1·42	3·45	2·74	·64	3·38
„ Bengal	2·28	1·74	4·02	3·31	·36	3·67
„ Madras	1·42	·62	2·04	1·67	—	1·67
„ Bombay	1·75	1·14	2·89	2·05	2·14	4·19

We have discussed this subject year after year, from the time that the very name of enteric fever did not appear in the statistics. We have shown how and when it first appeared, and the fever types from which enteric fever had been taken. The question at present, however, is not if there be such a disease in India, but whether, as shown by the figures, it is increasing. Instead of resuming the discussion, we shall simply quote the remarks of the Sanitary Commissioner in the present Report, which have an important bearing on the subject.

Referring to the preceding abstract, he says:—"The question as to whether all the fevers now so "often called enteric are really specifically distinct from malarial fevers, and whether, if these be so, "these fevers are specifically the same as the fevers similarly named in Europe, will have to be decided "on clinical and pathological data. As far as the indications of statistics may be relied on, they tend "to show only that, if the fevers now called enteric are really specifically distinct from malarial "fevers, they have always been so, though they have escaped observation, and are probably not to be "regarded as a newly introduced disease into India. It was, indeed, to be expected that a more careful "observation of fevers, stimulated by the introduction of improved and accessible instruments of "research, should result in the separation of some of their forms as distinct which were formerly "regarded as the same. This view is supported by the results set forth in the above tables, which "show that the total mortality from all forms of fever does not, on the whole, materially differ from "what it was 13 years ago, and this is hardly compatible with the view that a new and fatal fever "has been recently introduced into India."

19. *Post mortem* examinations may be assumed as having settled the diagnosis in the 151 fatal cases. But there were 644 cases of enteric fever admitted throughout the Army, and the diagnostic difficulty occurs not with the fatal cases, but with the admissions, while, so far as we can judge, there are considerable diversities of opinion as to what group of symptoms constitute a case as one of enteric fever. But so far as our own work is concerned, we should have no objections to assume all the cases as marking severe types of fever, requiring special local discussion and inquiry with the view of determining and dealing with their removable causes.

20. That there are local reasons of some kind or another to be dealt with scarcely admits of a doubt, even from the evidence furnished by statistics. For example, as we shall presently see, the amount and fatality of enteric fever depends on two numerical factors; 1st, the annual proportion of men under 25 years of age in the Indian European Army; 2nd, the proportion of these young men who have served for two years or under in the country. But it is at this point we find the question of locality presents itself, for on turning, for instance, to Dr. Stephen's tables, we find that at Agra and the six Central India stations, where there were 3,933 men, there were 64 enteric fever admissions, 30 of which proved fatal, and yielded a death-rate of 7·51 per 1,000 for the command. Of the cases 22 and 7 deaths took place at Agra, and 33 cases and 17 deaths at Morar.

We have already alluded to the comparatively new station of Quetta, in Southern Afghanistan, where 1,079 troops at the station and 1,088 in the Zhob expedition and on the march yielded, the former 32 enteric fever cases and 10 deaths, and the latter 3 cases and 1 death. This Afghanistan outbreak yielded an annual death-rate of 7·63 per 1,000, not far from the Central Indian rate.

Now, by way of contrast, let us take the Punjab stations, where 10,874 men yielded an enteric fever death-rate of 2·30 per 1,000, and the hill stations and sanitaria, where the enteric fever death-rate was 1·03 and 1·71 per 1,000, or the Madras stations, where the rate was 1·04 per 1,000.

21. If we are to assume young ages, short service, and climate as the determining causes of these various rates, are we in possession of facts to show that the proportion of men fulfilling these conditions varied so greatly in the different Army commands as to account for the facts of relative mortality? Of course, the reply is in the negative, so that without being obliged to deny that a young soldier may be struck with enteric fever immediately on his landing in India, we are compelled to seek for the causes of varying liability in the localities themselves, and it is here that the sanitary service has to be put under requisition to discover and remove the causes. After a man is in hospital, the insanitary conditions which sent him there have done their work. The distinction is an

important one, for it carries back the disease history to a period of days or even weeks before the patient came under medical care.

22. One chief use of the immense amount of sanitary statistical information which has been collected from every station in India, has been to enable the sanitary officer to lay his hand at once on local disease causes, and we must refer to the past annual figures for the stational information he requires. With that before him, he will have no difficulty in connecting enteric fever with general epidemic and local conditions, which lie at the root of other diseases of the class, for they are all of the same descent, although differing in external characters. There ought to be no great difficulty in dealing with the causes, if an attempt be made to realise what they are. And on this aspect of the question there is amply sufficient experience to guide us. Enteric fever has taken it victims from among all ranks of society, and from the inhabitants of palaces as well as from among the tenants of hovels. Its apparent impartiality in this respect has sometimes led to doubts of its relation to local conditions. But case after case has, on inquiry by skilful hands, led to a tolerably general conviction that in this, as in other instances of experience, there must be a cause preceding the effect; but we must avoid falling into the error that the complicated relations of what are called "disease causes" to the living healthy organism partake of the nature of ordinary chemical or mechanical agencies acting on dead matter.

23. A case of fever may be the final result of a failure of resistances against morbid agencies, as well as of the direct influence of the morbific agent. Take, for example, cases which have actually happened. A family inhabits a house, to the insanitary conditions of which its members have become more or less accustomed. A visitor arrives, and is attacked by fever, while the family escapes. Another family has occupied a house with apparent immunity until an accidental indraught of sewer air has lighted up fever. At the time a large mansion was built on clean gravel and on a healthy site, the great importance of isolating the rooms from any chance of air connexion with the subsoil was not recognised. Being lived on, the subsoil became in time unhealthy, and long years afterwards enteric fever entered the building.

A more common class of cases includes those in which whole streets of costly houses were erected without drainage. The house sewage was passed into cesspits to pollute the subsoil. In time the houses are drained, and the cesspits forgotten, until under certain changes of atmosphere enteric fever appears.

Take a late Indian case. The occupant of a ground floor bedroom was seized with fever, and had to undergo a long convalescence at a distance. Another occupant had a bed placed on the same spot, and was seized with enteric fever and died. The flooring was then removed, and the earth dug up. It smelt so bad that people were obliged to go away. This, which in all probability is a common Indian case, was caused by the infiltration of used bath water into the subsoil of the bedroom.

In India enteric fever has been assigned by medical officers who saw the cases to foul emanations from latrines, and to imperfect methods of dealing with latrine matter. Again, there is a whole class of cases in which enteric fever has appeared among troops camped on old used up ground, both in the East and West. Evidence taken before the Royal Commission of 1859 showed that an Indian cantonment is simply a town without drainage, and half a century ago Dr. Southwood Smith showed that wherever the Commissioners of Sewers in London had not been, there was fever.

24. Suppose, then, that a camp or barrack site has been used for a number of years, and the ground left to itself without drainage to enable the rainfall to wash out the subsoil; suppose, moreover, that no provision has been made for turning the roof water away from the foundations, and that in times past there have been cesspits and middens in use instead of cleansing, and that the barrack room air is in communication with the subsoil air to which the usual lavatory water has access. Is it not rather a matter of surprise that there are so few fatal cases at fever stations so managed?

25. All these are merely commonplaces of every day sanitary experience, and no doubt they could be added to by the experience of most Indian stations. There are instances in which these fevers have apparently been connected with the use of bad water. But, taking the facts as a whole, it will be found that the evil is generally in the subsoil, and it is there it has to be dealt with. But there are cases in which the fever cause may have been brought by air currents from a distance, so as to reach men in upper floor rooms more readily than those on the ground floor, thereby discrediting upper floors. These, however, are exceptional, and there are cases which are traceable to the topographical relations of the subsoil, by which water may be retained in underground pits and hollows not visible on the surface.

26. The object of these remarks is to show in what direction local inquiries at the enteric fever stations enumerated in Dr. Stephen's statistics ought to be carried out, and we need only add that it is time this work was undertaken. Mere surface appearances cannot be trusted to any longer. So far as these are concerned, the Sanitary Commissioner informs us that medical officers state that "no clue "whatever can be found to the causation of the disease in any local unsanitary conditions." Should this view be finally established, the practical result would apparently be to confirm the opinions of those officers who consider enteric fever as being a condition or stage of Indian fevers, and as these fevers are the products of malaria and climatic causes, we should have to deal with these general agencies instead of with local causes, such as are elsewhere connected with this fatal disease. But until the subsoil conditions existing at old stations and the relation of these to the barrack atmosphere have been worked out, it would scarcely be justifiable to conclude that causes of a local nature have nothing to do with a fever which is now the chief death cause in the European Army of India.

27. As we have discussed this subject at length in other papers with special reference to the relation of enteric fever to other Indian fevers, it is unnecessary to do more than merely to state,

that if the view held by some medical officers as to the identity of all these fevers were adopted, it would in no way change the character of the sanitary works and measures required at the stations, but it would necessitate the extension of them beyond the station limits, so as to include outside sources of malaria. It will, however, be quite time enough to deal with this aspect of the question when the stations have undergone thorough drainage and cleansing of their own subsoils, and when the men's rooms have had their ventilation cut off from that of the subsoil.

28. The next abstract gives the death-rates for a series of years from dysentery and hepatitis:—

Periods.	Death Ratios per 1,000.							
	Army of Bengal.		Army of Madras.		Army of Bombay.		Army of India.	
	Dysentery.	Hepatitis.	Dysentery.	Hepatitis.	Dysentery.	Hepatitis.	Dysentery.	Hepatitis.
1860–69	2·72	3·31	—	—	—	—	—	—
1870–79*	1·37	2·06	2·32	3·16	·98	1·71	1·48	2·19
1880	2·72†	1·36†	·58	1·26	4·14	1·37	2·96	1·33
1881†	1·00	1·64	1·15	1·54	1·82	1·52	1·72*	1·60*
1882	·77	1·48	·36	1·72	·18	·81	·57	1·40
1883	·35	1·06	·28	1·72	·55	·82	·38	1·18
1884	·18	·84	·37	2·04	1·03	1·03	·38	1·11

* Including troops on active service and on the march. † Excluding troops in Afghanistan.

It is satisfactory to observe that there has been a constant decrease in mortality from dysentery and hepatitis for the Indian Army as a whole. The decrease has been most marked in the Bengal Army. But in the Army of Madras there has been an increased mortality under both heads. Why the Madras rates should be so much higher than those of the other Armies has not yet been explained.

The best prophylactics against both diseases are temperate habits, including abstinence from spirituous drinks, flannel next the skin, managing the night ventilation so that air draughts are kept from falling on the men at night, and attention to clothing, to meet varied changes of temperature.

29. Admissions and deaths from sunstroke and apoplexy are nearly a constant quantity. In 1884 the admissions were 3 per 1,000 and the deaths 1·09 per 1,000. It is to be feared that some part of this loss is due to drink as well as to climatic causes.

30. Respiratory diseases are not subject to much variation in the Indian Army as a whole. In 1884 the admissions under this head were 73 per 1,000, of which just a tenth part, or 0·73 per 1,000, proved fatal. There was a considerable increase, however, in the Bombay Army due to the cold variable climate of Quetta, where part of the troops were stationed.

31. We have already referred to the unsatisfactory state of Army health from the amount of venereal diseases, which show a tendency to increase rather than to diminution. The earliest records show that during the ten years, 1860—69, the Bengal Army had a venereal admission-rate of 265 per 1,000, which in 1884 had risen to 291 per 1,000. The earliest accounts for the whole Indian army are those for the ten years, 1870—79, which gave a rate of 203 per 1,000, while the rate of 1884 was 294 per 1,000. The greatest increase, however, has been in the Madras Army, which has risen from an average of 198 per 1,000 in the ten years, 1870—79, to no less than 397 per 1,000 in 1884. Active police and lock hospital precautions have been in force everywhere, and special attention was drawn by us formerly to the apparent success of these measures in Bombay. But the statistics show that, including the periods before and since the precautions were introduced, the syphilitic rate has risen from a ten years' average, 1870—79, of 191 per 1,000 to 292 per 1,000 in 1884.

The whole subject appears to be surrounded with insurmountable difficulties, for in every Government the disease has advanced in the face of every means of prevention which have been adopted.

Some individual stations present extraordinary results. Madras, for example, is supposed to have an efficient police and lock hospital system, and yet in 1884 its venereal admissions were 485·3 per 1,000, Belgaum of 377·8 per 1,000, and Calicut of 390·1 per 1,000, but in this case there were under 100 troops.

32. *Invaliding.*—The following table gives the invaliding statistics for the year 1884:—

Armies.	Number invalided.	Invalided per 1,000 Strength.
Bengal	1,074	31·84
Madras	343	31·32
Bombay	340	31·36
India	1,757	31·74

Of the number invalided 1,035 were sent away for change and 722 for discharge. The chief invaliding cause was "debility," on account of which 266 men were sent home. There were 159 invalids from hepatitis. These two causes included about a fourth part of the invalids out of 106 assigned causes.

The invaliding rate was lower in 1884 than in any previous year, with one exception, and the figures given above show that it was nearly the same in all the Armies.

33. To recapitulate:—As has been already shown, there has been an apparent rise in the death-rate of the European Army as a whole, from 10·88 to 12·56 per 1,000, due to a considerable increase in the Bombay Army rate of 8·89 per 1,000. But this rate in its turn can be traced almost entirely to that part of the Bombay Army on service in Southern Afghanistan. The real rate due to the Bombay stations was 11·2 per 1,000 and the Afghanistan rate and its causes is a separate problem. Making allowance for this, we have shown that the death-rate of the European Indian Army, as a whole, was 11·2 per 1,000, or ·32 per 1,000 above the rate of 1883, which was 10·88 per 1,000, the lowest on record. The slight increase was mainly due to cholera in Meerut and Rohilkund, and shows the need of more active precautionary measures at these stations. This is the lesson taught by another year's experience, which, however, on the whole, and with the exception of the Afghanistan results, cannot be said to be unsatisfactory. The practical teaching of the year's facts for the whole Army is that every effort should be made to discover and root out the causes of enteric fever at the 45 stations which yielded deaths from this disease in 1884. That there are local causes for this mortality cannot admit of a doubt, although the necessarily surface observations of medical officers may have failed hitherto to discover them. And as these causes are dealt with we may rest assured that cholera, as well as enteric fever, will be less apt to enter, for there is every probability that the two diseases are localised by similar causes.

34. In former memoranda we have called attention to the apparently greater liability to death of newly arrived regiments, and as the experience of 1884 is exceptional in this matter, it is necessary to state it. The admission rate for the Army generally was 1513·4, the daily sick rate 67 per 1,000, and the death-rate 12·56 per 1,000. The corresponding ratios for newly arrived regiments were as follows:—

	Per 1,000.
Admissions	1341·6
Daily sick	62·2
Deaths	10·88

But the most important difference was in the enteric fever death-rate, which for the Army generally was 2·74 and for new regiments 2·33 per 1,000.

35. *European women and children.*—The death-rate among women was 17·50 per 1,000, the lowest on record. Ten years earlier, in 1875, the rate was 25·89 per 1,000. During the same year the children's death-rate was 69·75 per 1,000. In 1884 it was 54·86 per 1,000, but the children's rate is subject to greater variation than the rate for adults.

36. *Officers.*—The following abstract shows the death-ratios among officers:—

	Strength.	Deaths.	Ratio per 1,000.
British	2,773	29	10·7
Indian	2,929	25	8·5

Of the 54 deaths, 6 were due to enteric fever, 5 to cholera, and 5 to apoplexy. There were six deaths among the absent, and one death at sea.

37. Considered from the practical side, these statistics of the European Army as a whole show continuous improvement in the sanitary state of the Army, and that of late years much good has been done, and we shall next see that the health of the Native Army has undergone even greater relative improvement, although it has not as yet arrived at the same sanitary standard as that presented by the European Army.

38. *Native Army.*—Instead of abstracting full statistical details under this head, it will be sufficient to compare the earliest and latest years of the series, which stand as follow for the Native Army as a whole. For the years 1877 to 1881 the average inefficiency rates were:—

Admissions per 1,000	1,422
Daily sick ,,	48
Deaths, including absent deaths	27·40

The same data for 1884 were:—

Admissions per 1,000	1,042
Daily sick	33
Deaths, including absent deaths	12·22

Excluding absent deaths, the rate was 10·50 per 1,000, but as the European death-rate includes all deaths under its ratio of 11·2 per 1,000, after the corrections required for Quetta, it is this rate

which should be compared with the total Native Army rate, 12·22 per 1,000. The improvements in both rates have hence been very great, while they hold out expectations of still further reductions and increase of efficiency.

39. The next abstract shows the inefficiency rates per 1,000 for each of the Native Armies in 1884.

Armies.	Strength.	Ratios per 1,000 Strength.		
		Admissions.	Daily Sick.	Mortality, including absent Deaths.
Bengal	40,850	1,193	35	12·56
Madras	28,050	836	31	11·82
Bombay	23,373	1,159	38	14·35
Punjab Frontier Force	16,458	1,262	35	14·00
Central Indian Regiments	5,082	644	20	7·23
Hyderabad Contingent	7,014	574	19	5·30

40. The chief admission causes in the Native Army were fevers of the intermittent type, from which the admission-rate was 490·0 per 1,000, slightly above the rate for European troops, which was 486·9 per 1,000. Remittent and continued fevers yielded 12·3 per 1,000 in the Native Army, against 59·9 per 1,000 in the European Army. Dysentery yielded 48·7 admissions in the Native Army, against 29·2 in the European Army.

The chief death causes in the Native Army were respiratory diseases, from which there were 341 deaths, or 2·97 per 1,000. To this group was due 25 per cent. of the year's mortality, a fact which suggests inquiry regarding clothing and shelter, whether both are suited to the diverse climates where the Native Army serves.

There were 82 deaths from cholera, equal to 0·71 per 1,000, and 10 deaths from small-pox. The fevers proper gave rise to 207 deaths, or 1·80 per 1,000. Eleven of these deaths were attributed to enteric fever, 52 to intermittent, and 144 to remittent and continued fevers.

41. The death-rates of the Native Army were made up of various ratios, but some were so high as apparently to call for inquiry as to the sanitary condition of the stations.

Dhuki and Gumbuz yielded a death-rate of 68·35 per 1,000, Dibrugarh of 25·7 per 1,000, Dehra Dun of 25·27 per 1,000, Alipore and Baliganj of 24·24 per 1,000. It is not at all unlikely that skilled sanitary inquiry would find some reason for these rates. So far as can be estimated from the tabular statement of Native station returns, there are many disease causes connected with the lines and hutting which require attention.

42. *Jails.*—Section IV., which is devoted to an account of statistics and sanitary condition of jails all over India, contains much useful information regarding 252 of these establishments. Of late years much good work appears to have been done in many of them, and the following abstract shows that the health of prisoners has improved:—

Periods.	Average Strength.	Ratios per 1,000.		
		Admissions.	Daily Sick.	Deaths.
1872–76	99,758	1,016	?	36·24
1877–81	112,670	1,189	44·9	63·01
1880	106,763	1,213	46·	48·31
1881	100,344	1,214	45·	44·03
1882	94,063	1,214	42·	39·96
1883	88,174	996	36·	34·37
1884	85,496	1,025	37·	29·11

During the years shown in this table there has been a great and continuous reduction in the death-rates, and this improvement has co-existed with reduction in the prison population, which means less crowding and more ventilation.

43. The data for the jails of each Presidency for the year 1884 have been as follows:—

Presidencies.	Average Strength.	Ratios per 1,000.		
		Admissions.	Daily Sick.	Deaths.
Bengal	51,877	1,028	34	32·71
Madras	6,959	765	29	30·55
Bombay	7,305	702	26	34·91

The largest amount of sickness is thus shown to have prevailed in the Bengal jails, the highest death-rate in the Bombay jails, and the lowest in Madras jails.

44. We shall next compare the admission and death-rates from the chief diseases during 1884 with those of the previous ten years:—

Diseases.	Ratios per 1,000.			
	Admissions, 1873-82.	Deaths, 1873-82.	Admissions, 1884.	Deaths, 1884.
Dysentery and diarrhœa	175	13·90	223	12·66
Respiratory diseases	44	7·16	36	6·03
Fevers	488	5·29	452	2·16
Cholera	?	3·46	2·9	1·52
Atrophy and anæmia	28	3·10	28	2·10
Phthisis pulmonalis	?	·50	5·7	2·12
Dropsy	?	·80	3·6	·85
Wounds and accidents	41	·68	35	·46
Spleen diseases	?	·35	5·9	·27
Apoplexy	?	·66	·4	·52

We have no means of completing the admission column for the ten years, but the death columns show a remarkable reduction in this datum for all the chief prison diseases.

45. Like many other averages, however, these general data are deceptive, for they are made up of maxima and minima; but as the statistics of each jail are given in the Report, we may obtain a more accurate idea of the jail mortality by arranging the data so as to show the number of jails in which specified death-rates prevailed in 1884:—

Death-rates per 1,000 average Strength.	Number of Jails in which the Rates existed.
Under 10	19
10 to 20	57
20 to 30	46
30 to 40	24
40 to 50	21
50 to 60	14
60 to 70	8
70 to 80	6
80 to 90	2
100 to 110	6
120 to 130	2
140 to 150	1
150 to 160	2
256·52	1
Total	209

It is quite certain from these figures that the death-rates in many jails are excessive, but in 1884 part of the high rates was due to cholera, which appeared in 32 of them at a time when it was epidemic in the districts within which the jails are situated. But the other jails, which were also in cholera districts, escaped. Thus Julpaiguri jail, which had a death-rate of 155·96 per 1,000, had no cholera. Mymensingh jail, with a death-rate of 148·88 per 1,000, had only three cholera deaths. And Rungpore jail, which yielded the highest death-rate of the year, namely, 256·52 per 1,000, had no cholera. The preceding abstracts show that, out of an average death-rate of 29·11 per 1,000, the cholera-rate was 1·52 per 1,000, somewhat in excess of 1·43 per 1,000 which ruled all over India. But the cholera death-rate in certain jails greatly exceeded this average. In Gya the death-rate from cholera was 24·26 per 1,000. In Monghyr it was 36·08 per 1,000, and in Akyab jail it was 52·63 per 1,000. No doubt the importance of the figures is lessened by the comparative smallness of the jail population in several of the 32 jails where the disease appeared. But there is also the more satisfactory result that, while the previous ten years' cholera death-rate in jails had been 3·46 per 1,000, the rate for 1884 was less than one-half of this amount. This reduction in the midst of a severe cholera epidemic affords evidence of good work done in many jails.

The chief death causes during 1884 were, dysentery and diarrhœa 12·66, respiratory diseases and phthisis 8·15, and fevers 2·16 per 1,000. Broken down constitutions yielded a rate of 2·95 per 1,000, under the heads of atrophy, anæmia, and dropsy. Leaving these last out of reckoning, nearly the whole of the remaining mortality comes under the head of mitigable or preventible diseases, all of which have of late years undergone marked reduction under improved sanitary administration. If we were to judge solely by the average mortality, the state of Indian jails must be considered as not unfavourable for India, but the real test of progress is not reduced average mortality all over an area, but reduced mortality in districts and circumscribed localities, and, viewed in this way, it is evident that great improvements are required.

46. Of course, the health of prisoners at any given time is the result not of one or two conditions, but of all the circumstances and surroundings of the prison population, such as ages, previous health and disease predisposition, diet, work, and the relation of diet to work, exposure, clothing, climate, locality and neighbourhood, prison construction and arrangements, water-supply, drainage, and such like. Many of these conditions belong to prison administration, and do not come within our sphere, but there are others on which it is our duty to express an opinion, and perhaps the best way of showing what these points are will be simply to abstract very briefly the information contained in the summary of the jail sanitary sheets in the Report under review.

The following items give the number of instances in which defects are noticed in the sheets, but some jails are entered more than once, as having more than one defect:—

Nature of Defect.	Number of Jails in which Defects are stated to exist.
Defective ventilation of dormitories, including excesses	28
Defective construction arrangements	3
Insanitary surroundings of jails	21
Extremes of heat and cold	6
Overcrowding, generally of a temporary kind	63
Bad or unprotected water-supply	15
Bad drainage arrangements of jails and surroundings	23
Damp rooms	2
Bad malarious locality	11
Insufficient clothing	4

To these must be added the necessary results of long occupied undrained sites, especially where the jail sewage has been buried near the buildings, and wherever these exist, and to the extent in which they exist, there are the predisposing causes of the endemic and epidemic diseases shown in the preceding tables.

There is nothing new in the facts, for they have been reproduced year after year in the jail sanitary sheets. There have been frequent discussions on the death-rates of Indian jails and their causes, and there has been an anxious desire to sweep away the excesses in them. But there is one fact that should be clearly kept in view, and this is that the causes of disease predisposition recorded in the sanitary sheets are those observed on the spot by the jail officers, and for practical purposes it is these with which we have to deal. When these defects have been removed it will be quite time enough to discuss the remaining death-rates and their causes.

Besides jails in which there are assigned defects, there are 40 jails in the lists to which no defects are attributed, and, with a few exceptional cases, all these jails are those included under the lowest death-rates in the preceding abstract.

47. In considering the sanitary notes in this jail table, and the use to which the information may be applied without difficulty, it appears to us that if the stations, barracks, and hospitals of European troops were treated with equal fullness, and the details tabulated, we should have less difficulty in tracing back to their causes enteric fever and cholera than we have hitherto had. We have much information about the local sanitary defects of jails which we would earnestly desire to see turned to account, and at present we should be glad of similar information about European stations, descending even to the sanitary details of individual barrack blocks.

48. *Sanitary History of the Civil Population of India for the Year* 1884.—In our memoranda on the sanitary reports of the different Governments we have entered on the details presented by each, and we shall, under the present head, give a summary of the year's results for the populations of India as a whole.

The population making returns of deaths in 1884 amounted to 197,713,629, and this number represents the maximum registration area having a surface of 839,723 square miles. But the birth registration is not yet coterminous with that of deaths, because in Bengal births are as yet registered in only 47 municipalities and towns, having a population of 1,685,651, and the population of districts within which town births are registered is 133,235,391. The actual number of births for the whole population of India cannot yet be arrived at, but in each of our Memoranda we have given the numbers for the Government.

49. The following were the mean birth-rates in each group:—

	Births per 1,000 of Population (means).
Bengal, 47 municipalities	23·51
North-West Provinces and Oudh	43·77
Punjab	42·98
Central Provinces	41·75
Berar	41·30
British Burma	22·66
Assam	26·61
Madras Presidency	29·30
Bombay	32·50
Mysore	23·20
Coorg	14·87

Some of the rates are more near accuracy than are others, but as yet the birth-rates are only approximations to the truth.

50. The total deaths registered from all causes amounted to 5,225,962, or nearly 26½ per 1,000 of the registering population, which is a closer approximation to the true death-rate than has been hitherto arrived at. Of course it is still far short of the truth for a country of great epidemics.

51. The next table copied in abstract from the Report gives interesting information regarding the registration of deaths in each Government:—

Provinces.	Number of Registration Circles.		Population.		Deaths per 1,000.		
	Rural.	Town.	Rural.	Town.	Rural.	Town.	Total.
Bengal	553	96	63,705,518	2,458,366	20·58	27·43	20·83
North-West Provinces and Oudh	1,044	102	41,358,922	2,748,947	34·78	42·47	35·26
Punjab	395	49	17,512,378	1,310,383	35·	41·	35·04
Central Provinces	95	73	8,060,093	757,092	27·48	25·37	27·30
Berar	109	11	2,491,640	138,378	24·60	27·4	24·6
British Burma	823	20	3,227,854	425,775	16·61	36·65	18·95
Assam	639	22	4,427,384	100,550	29·31	32·09	29·37
Madras Presidency	153	76	26,485,071	1,699,607	22·70	27·70	23·10
Bombay	221	62	14,348,658	2,105,756	24·17	29·25	24·82
Mysore	42	18	3,945,547	240,641	14·96	14·57	14·93
Coorg	5	1	172,075	6,227	15·24	10·44	15·08

This table shows that registration is in a more advanced state in the North-West Provinces and Oudh, and in the Punjab, than in any other Indian Government, but it affords no evidence that the population is more unhealthy. In the other Governments much remains to be done before the real sanitary condition of the people is fully known, but it is quite safe to say, that if the executive sanitary administration for saving life had a more close correspondence with the existing registration machinery for telling us how many people have died from preventable diseases, we should have less to complain of about epidemics. Nearly all the sanitary work is done in the town circles, and if we compare the population of these with the enormous rural populations, we may be better prepared to recognize where work requires to be done.

52. We shall next state the assigned death causes in 1884. They were as follows, and we have added the data for 1883 :—

	1884.	1883.
Cholera	282,815	244,376
Small-pox	332,904	232,363
Fevers	3,806,285	2,879,659
Bowel complaints	274,234	261,623
Injuries	76,588	76,059
All other causes	953,141	889,243
Total registered deaths	5,225,962	4,583,323

These figures show that the deaths from cholera accounted for a very limited part of the year's mortality; that small-pox prevailed as a great epidemic in face of the extensive vaccination service; that the great death cause in 1884, as in previous years, was "fever," and that a large proportion of the deaths is still unaccounted for.

Among the "injuries" were included 8,195 suicides and 23,028 deaths from snake-bite and wild beasts, but the former are not stated separately.

53. The next abstract enables us to compare the death-rates from these diseases in each Government in 1884.

Provinces.	Death-rates per 1,000 of Population.					
	Cholera.	Small-pox.	Fevers.	Bowel Complaints.	Injuries.	All other Causes.
Bengal	2·03	·28	14·60	·88	·37	2·66
Assam	4·92	4 0	14·69	3·56	·26	4·87
North-West Provinces and Oudh	·68	·59	24·35	1·73	·48	3·42
Punjab	·03	·87	24·71	·97	·29	8·16
Central Provinces	·02	·55	16·48	2·49	·51	7·25
Berar	·03	·20	11·60	3·50	·40	8·90
British Burma	1·51	1·67	8·08	1·02	·14	6·53
Madras Presidency	2·70	2·10	7·60	1·00	·40	9·10
Bombay ,,	·84	·88	16·83	2·19	·34	3·74
Mysore ,,	·08	·77	7·98	1·19	·26	4·71
Coorg	—	·61	12·85	·50	·18	·94

From cholera, Assam and Madras suffered most severely, next followed Bengal, and in the other Governments cholera was of little importance. The small-pox epidemic of 1884 fell with great

violence on the North-West Provinces and Oudh, where no fewer than 202,541 victims died of it. This, however, was only a part of the loss, for in 1883 there were 138,641 deaths from the disease, giving for the two years no fewer than 341,182 deaths in these provinces, where for many years an active and apparently not inefficient vaccination service had been in existence. The average annual vaccinations reported as successful during five years preceding 1884 were 622,394, and in the latter year 568,372. This experience merely shows that without calling in question the modifying influence of vaccination in ordinary years, it cannot be depended on for safety during epidemics.

Diseases classed as fevers were most fatal in these same provinces and in the Punjab, where they are connected with local irrigation works, defective drainage, and bad habitations of the working classes.

54. The facts, as a whole, show that there was a large increase of deaths among the Native population in 1884; that this increase amounted to 642,639 in the death registration; that it was made up by an addition of 38,539 deaths from cholera, 100,541 deaths from small-pox, 426,626 deaths from fevers, and 12,612 deaths from bowel complaints. The entire year's increase and more was due solely to epidemics, and this fact affords the only clue to the required remedies. The epidemic and local causes in India are quite well known, but up to the present time the epidemic statistics show conclusively that little or no reduction of them has been made by the sanitary executive, where there happens to be one.

55. So far as the few notes on the sanitary condition of stations of British troops quoted from medical officers reports by the Sanitary Commissioner afford us any guidance, they show not that adequate local causes did not exist, but only that the persons charged with discovery and dealing with them failed to discover them. This is further shown by exceptional cases in which patent causes are described and cholera followed.

56. The Sanitary Commissioner states that of 26 communities of British troops attacked by cholera, in 21 diarrhœa is stated not to have been present, and in only five out of 21 Native communties was diarrhœa observed. The experience is certainly not usual, and we should expect that the disease history would show sudden attacks if we had it before us. It is not necessary that diarrhœa should exist for weeks or even for days before attack, a few hours of neglected bowel discharge may make all the difference in the result of a cholera attack.

57. In continuation of the experience of liability to attacks of cholera among attendants, it is stated that 411 cases of cholera were attended by 893 persons, of whom nine were attacked. The facts when analysed yield the following results:

There were 132 cases of cholera among British troops attended by 364 persons, of whom two were attacked.

Among Native troops, 66 cases were attended by 277 persons, of whom none were attacked.

Most of the attacks really took place among officials within jails, of whom 252 attended on 163 cases of cholera and seven were attached. These were of course exposed to local jail conditions.

58. The effect of removal of troops from cholera-stricken localities was "as usual most beneficial "among British troops. Cholera appeared in 26 communities, and in 15 of these movements were "made into camp, in three to different barracks, and in eight the disease occurred in an isolated "form, and no movement was considered necessary. In 10 of the 15 movements into camp no "further case occurred after movement."

Then next follows this statement:—"At Allahabad, where 19 cases occurred in all, only one man "was attacked after the affected community moved into camp." Now the statistics inform us that there were six deaths from cholera out of 789 men at Allahabad, or 7·60 per 1,000, a result which appears to justify the question on what principle the men were kept there and not removed at once. At Meerut there were cholera cases after removal into camp, but in this case we require dates of first appearance of cholera and dates of removal, and, moreover, we should have the cholera history of the country where the camps were formed.

We desire to repeat what we have often said, namely, that when cholera breaks out at a station it has already become a cholera locality, as much so indeed as an attacked village. Movement must be made whenever reasonable suspicion of this matter exists, and if it is delayed until successive cases show themselves, we must not be surprised if cholera appears in camp. Besides this, if local knowledge tells us where cholera is or is likely to be, we must not go there to meet it, we must go elsewhere.

59. *Vaccination service.*—We have already stated the leading facts regarding the small-pox epidemic of 1884, and we shall next give briefly the results of vaccinations over the whole of India for the same year.

The vaccination staff was constituted as follows:—

Sanitary Commissioners	9
Deputy ditto	14
Superintendents	45*
Deputy ditto	21
Native ditto	277
Average vaccinators	3,895†
Total staff	4,261†

The total number of persons vaccinated in 1884 by this special establishment amounted to no fewer than 5,834,871. The total primary vaccinations were 4,443,246, and there were 84,700

* Including Civil Surgeons. † Including 1,067 licensed vaccinators.

successful re-vaccinations. Of the successful vaccinations 1,752,370 were performed in children under one year of age, and 2,113,443 between the ages of one and six years. To this work of the special establishment has to be added 237,342 successful primary vaccinations performed at the dispensaries, of which 66,568 were under one year of age.

The births are estimated in one of the tables, on a ratio of 40 per 1,000 of the population, at 7,538,206, which is probably above the real number, while the successful vaccinations under one year reached only 1,828,059, or less than a fourth part of the estimated births.

This is the only safe way of testing the probable effect of vaccination, for whatever the number of vaccinations above one year may amount to, we have added year by year some millions of infants who are the most susceptible subjects to attacks of small-pox, only one fourth part of the number being protected. Notwithstanding the very great amount of work shown by the tables, it cannot be said that the direction taken by it is altogether satisfactory. But withall, we must remember that small-pox is not only a disease to be modified, but it may become at any time, as it did in 1884, a great epidemic, to be met only by sanitary measures and works in localities.

60. *Sanitary Works (Military).*—The only information under this head, which forms Section VIII. of the Report, is the following summary of expenditure:—

	Rs.
Original works	2,025,943
Repairs	1,761,009
Establishment	1,434,978
Tools and plant	49,854
Barrack Department	478,246
Total	5,750,030

Under the same head are given brief notes bearing on the sanitary state of 69 cantonments in Bengal Presidency. They are not sanitary reports properly so called, and they deal with general rather than with local disease causes, and the diseases connected with them. Take the following as examples:—At Chunar there were 77 British troops with a death-rate of 25·97 per 1,000. These 77 men yielded no fewer than nine admissions from enteric fever, of which, however, all recovered. The only note on these cases is "enteric fever was prevalent among the British troops during the "first five weeks of the year."

At Benares, in 10 months, 318 men yielded eight cases and three deaths from enteric fever, and the remark is "enteric fever during August, September, and October, due to climatic causes."

Allahabad, out of 789 men, had two non-fatal cases of enteric fever, but it yielded 11 cases and six deaths from cholera. The note on this case is more explicit; it is as follows:—"Fevers in "August, September, and October, due to climatic causes and malaria. The ground on which the "E. I. barracks are built is somewhat low and damp, and its surface drainage admits of improvement. "Recommended that the ground in the immediate vicinity of the barracks of the Royal Artillery "and British Infantry be broken up and sown with grass seed."

Lucknow, out of a strength of 2,115 men, had 55 cases and nine deaths from enteric fever and two fatal cases of cholera, and the Report assigns as causes "a large number of men being young "and recent arrivals in the country. The trenches should be at some distance from the barracks." It need scarcely be said that, with so large a force, the night-soil should be disposed of away from the cantonment site altogether.

Meerut had a strength of 1,682 men. It had 21 cases of enteric fever, of which five proved fatal. It had besides 28 cases and 13 deaths from cholera. The note on these losses is as follows:—"Cholera probably due to insanitary conditions and seasonal influences. Ague due to unusual heavy "rains, and malarious fevers to insanitary and seasonal influences."

The cause most generally assigned for sickness is malaria, but in no case, so far as we know, has any attempt been made to deal with purely local malarial causes in the immediate vicinity of the barracks themselves, or by ventilating underneath the barrack floors. It is many years since we advised that trials of works such as these should be made.

61. Under the head of "Sanitary Works, Civil," there is nothing calling for special remark, as we have already dealt with the subject in our Memoranda on the proceedings in each separate Government. This Section IX. merely gives a brief sketch of the year's results.

62. *General remarks.*—The most interesting practical subject dealt with in this section is the result up to the present time of the application of sanitary principles to the protection of health during the Mecca pilgrimages. Until of late years, little was known of the conditions under which these assemblages were held, although from the little that was known it was safely inferred that they partook largely of the character of ordinary large and crowded Indian festivals as those existed in the older time. If any cholera was about it was almost certain to alight at Mecca, and then the blame was laid anywhere than on the right shoulders. The present state of matters will be best described in the words of the Sanitary Commissioner: he says, "The complete immunity from "cholera enjoyed by the pilgrims to Mecca during the Haj of 1884, together with the diminished "prevalence of sickness generally, is most gratifying evidence of the beneficial effects of a stricter "attention to sanitation. Vice-Consul Dr. Abdur Razzak, in his excellent report on the health of "the pilgrims, pertinently remarks with reference to the absence of cholera that this will doubtless "be attributed by some to the increased vigilance displayed by the Turkish authorities during the "year in connection with quarantine, but he proceeds to show that the result may, with greater "probability, be traced to local natural and artificial causes. The sanitary condition of Mecca and

" Moona was greatly improved, surface cleanliness and conservancy having been carefully attended " to. Moreover, the water-supply for the use of pilgrims at Moona was of much better quality." " Slaughter sheds also were erected at distances from one another, instead of being aggregated " together as formerly, and arrangements were made for burying the carcases of sacrificed animals, " instead of allowing them to putrify on the surface. The encamping ground was more openly " occupied, a larger space having been available owing to the absence of Persian pilgrims. . . " Together with this greater attention to the elementary rules of sanitation, the weather was " unusually favourable, heat was less, and cool breezes prevailed at times. It seems, therefore, more " reasonable to ascribe the immunity from cholera and the lessened prevalence of disease generally " among the pilgrims to those causes than to look for an explanation of the absence of cholera to " imperfectly conducted measures of quarantine. The futility of quarantine, even when enforced " with every possible rigour, has been demonstrated time after time, and has been admitted at the " recent International Conference assembled at Rome by some of the most advanced contagionists."

63. Although this favourable experience has only been for one season, the sanitary measures adopted, so far as we can judge of them, were those most likely to bring about the result. But everything depends on their rigourous and continuous application, and as this Mecca cholera has an important bearing on commercial interests it should be a matter of public concern to see that this is done.

64. The only other matter requiring notice is the first result arrived at by Surgeon-Major Dr. D. Cunningham in tracing the life history of the so-called comma-bacillus in the new pathological laboratory at Calcutta. This inquiry is contained in Part I. of the new Scientific Memoirs of Medical Officers of the Army in India, which includes two papers (4). "On the relation of Cholera " to Schizomycete Organisms;" (2) also by Dr. Cunningham "On the presence of peculiar Parasitic " Organisms in the Tissue of a specimen of Delhi Boil."

The first paper confirms the observations of Dr. Koch and Drs. Klein and Gibbes as to the occurrence of the curved bacillus in cases of cholera, and also of a curved bacillus elsewhere, having a different life history from Dr. Koch's form. It is also shown that the true comma-bacillus of Dr. Koch is an organism subject to metamorphosis, and presenting very different characters when cultivated under different media, but for our practical purposes this brings us no nearer our end than we were. Only it is shown that Dr. Koch's organism is an inhabitant of Calcutta foul water tanks where no cholera existed in the vicinity. This paper is merely a first and very necessary instalment of the work which will, no doubt, be ably carried through by Dr. Cunningham. His conclusion in regard to the Delhi sore is that the disease processes may " certainly be associated with, and possibly " caused by, the presence of peculiar parasitic bodies. In regard to this, however, it appears to be " quite possible that such bodies may constitute a real cause of such disease without necessarily " constituting its only cause."

65. In conclusion, the large amount of interesting information on the whole sanitary history of India contained in this Report of the Sanitary Commissioner and in Dr. Stephen's statistical tables helps to bring out certain definite results of great practical importance. First among these is, that for another year the death-rate of British troops has held the favourable position which it attained in 1883, with only a slight addition from cholera at one group of Bengal stations.

The statistics for the Native Army show similar results as those of the preceding year.

The chief death cause in the European Army in India is enteric fever, from which, in 1884, the admission-rate was 11·7 per 1,000 and the death-rate 2·34 per 1,000; ratios which may be contrasted with those for the Home Army in 1883, which yielded 1·3 per 1,000 admissions and ·24 per 1,000 deaths. The Indian admission-rate was ninefold and the death-rate twelvefold that of the Army at home. The contrast is otherwise of importance, because it shows that, as both the Indian and Home Armies contain many young men, there must be some other factor besides youth to account for this difference of liability to fatal fever. No doubt heat and other climatic influences add to enteric fever liability in India, but the amount of this liability cannot be estimated until we shall have freed Indian stations from these local fever causes which we know from home experience to be connected with liability to enteric fever in the colder climate of home stations. There is plenty of evidence to show that these local causes are closely related to the subsoil conditions under and around barracks in India, and that it would be very advisable to deal practically with at least one enteric fever station on this ground. There is also experience to show that enteric fever stations are liable to outbreaks of cholera, and the relation of local insanitary conditions to the latter disease is proved by the arrest put on it by the removal of troops. It is even not at all improbable that change from an enteric fever station into a healthy camp might be of use.

But another local cause of enteric fever, known both at home and in India, is neighbourhood of unhealthy and insanitary localities and population, and it is here that the sanitary state of European troops connects itself with the sanitary state of the Native population.

Without calling in question the difficulties of this aspect of the case, we cannot escape from the statistical facts showing the great losses in many ways which India has to bear from the prevalence of great epidemics, the local causes of which have been long made out. We are bound in the interests of the public health to recommend that these causes should be grappled with firmly on the principles we have laid down in former Memoranda, as well as in our suggestions for the improvement of Indian stations and their vicinity reissued in 1882.

This recommendation, together with the removal of local subsoil causes of enteric fever and other epidemics at European stations, are the principal conclusions of a practical kind deducible from the Report under review.

22nd June 1886.

No. 2.

Memorandum of the Army Sanitary Commission on the Report of the Sanitary Commissioner for Madras for 1884.

1. The population of Madras Presidency at the last census in 1881, and exclusive of Europeans and Eurasians, was 30,835,771. But the number from which returns of births and deaths were received in 1884 amounted to 28,151,052.

2. The births registered among this population were 423,108 males and 404,273 females, together 827,381, yielding a birth-rate of 29·3 per 1,000, probably under the truth, as the rates varied considerably in different districts. The lowest rate, 17·1 per 1,000, was returned from the Nilgiris, and the highest, 41·4 per 1,000, from Chingleput. The average male births were 104·6 to 100 births of females.

3. The same population returned 334,044 deaths of males and 316,291 deaths of females, together 650,335, equal to a death-rate of 23·1 per 1,000. Of males 105·6 died for every 100 females. The lowest district death-rate registered was 14·5 per 1,000 in Ganjam and Nellore. The highest was 49·4 in Madras. The lower rates are too low, but the nearly 5 per cent. death-rate for Madras is apparently too high, possibly from under-estimating the population. The fact, however, appears to be that, out of an assumed population of 389,984, the registered deaths were 19,279. Taken according to sex, the male deaths were 50·05 per 1,000 and the female deaths 48·3 per 1,000. Here, surely, is a case calling for very active interference, for if this state of matters is allowed to continue Madras may have the unenviable reputation of being the most unhealthy city in India.

4. The next abstract shows the deaths returned according to age in 1884:—

Under one year	141,872
One and under 15	173,703
15 to 50	201,268
Over 50	133,492

These figures are only rough approximations to the facts, for the mortality of infants is apparently too low when the sanitary state of Madras Presidency is considered.

5. The next abstract gives the death causes of the year:—

Diseases.	Deaths.	Deaths per 1,000 of Population.
Cholera	75,476	2·6
Small-pox	61,347	2·1
Fever	215,977	7·6
Bowel complaints	28,775	1·0
Injuries	11,502	0·4
All other causes	257,358	9·1
All causes	630,335	23·0

The previous five years' death-rate was 17·2 per 1,000, but this rate and the rate of 23 per 1,000 for the year 1884 are both much below the truth. All that the table shows is that more deaths were registered in 1884 than the average of previous years.

6. Registration is better done in the towns than in the districts, as is shown by the fact that the average death-rate for 76 towns was 23·7 per 1,000, against a previous five years' average of 23·8 per 1,000, while the district rate was 22·7 in 1884, and the previous five years' rate was 16·8 per 1,000.

7. We shall next give a brief sketch of the disease history of 1884, beginning with cholera.

The year 1866 was remarkable for its great loss of life from cholera, amounting to no fewer than 200,961 deaths. This great epidemic was followed by a brief period of decline and increase until the next maximum year, 1870, when there were 55,867 deaths. The annual cholera mortality thereafter declined until it reached its lowest registered rate, which was only 313 deaths in 1875, but there succeeded to this time of quiescence a great epidemic outbreak, culminating in 357,430 deaths in 1877. The mortality then declined to 613 deaths in 1880, when there came another epidemic period, still apparently in progress, for since that year the recorded cholera mortality has been as follows:—

Years.	Cholera Deaths.
1881	9,446
1882	23,604
1883	36,284
1884	75,476

8. During the last of these years cholera deaths were returned from all the 22 districts, with the exception of South Canara. But the epidemic was very unequally distributed. The lowest rate, 0·007 per 1,000, was returned from Vizagapatam, and the highest was 11·1 per 1,000 from Tanjore. Of the 76 towns, nine escaped the disease, while all the others suffered more or less. The town rates varied from scarcely appreciable ratios to some of the highest rates on record. There were town ratios of 10, 12, 14, and above 15 per 1,000, and two towns, Rajahpoliem and Sivagiri, had death-rates of

52·7 and 63·4 per 1,000. The conjoined population of these two towns was, it is true, not large, only 25,653, but, nevertheless, 1,946 of them were cut off. They appear to afford examples of intense *local explosions, which were not* unfrequent, and made up the death-rate, rather than by extent of *epidemic prevalence. There are* 229 registration circles in Madras, 178 of which returned cholera *deaths, and out of 52,051 villages* 7,225 yielded all the district deaths, or on an average of 10 per *village.*

9. *As will* be seen from the following abstract, cholera prevailed during every month of 1884 :—

Months.	Cholera Deaths.	Months.	Cholera Deaths.
January - -	21,268	July - -	6,267
February - -	7,562	August - -	3,298
March - -	2,374	September - -	2,677
April - -	1,550	October - -	1,645
May - -	2,[illegible]8	November - -	3,639
June - -	3,975	December - -	19,313

10. In the course of the year the office of sanitary commissioner was transferred from Dr. Furnell to Dr. Bidie, and there was consequently no information available on which any account of the sanitary condition of affected localities could be based, but Dr. Furnell has promised a special report on the subject. One very important conclusion may, however, be drawn, and this is, that the epidemic cholera of 1884 has published its own report in the local death statistics, and, when taken in connexion with the past history of the disease in the Presidency, it has proclaimed distinctly enough that responsibility rests somewhere for the immense losses which have fallen on the people. There is one district, Tanjore, in which cholera has been prevalent ever since registration has been introduced. In this single district all the 14 registration circles furnished deaths from cholera, as did also 1,977 villages out of 3,551, and 23,671 people died of it. The death-rate was 11·1 per 1,000, against a previous five years' average of 1·8 per 1,000.

The present Report informs us that these facts "caused much anxiety to Government," and an inquiry was invited. Some examination was made, but in a case like this we ought to have had an exhaustive sanitary report on the whole area and its villages, and the special causes of the mortality ought to have been distinctly traced, and steps taken at once to save life by their removal. This is what naturally would have been done in England in former days. But instead of this course, we have no report at all, and only unproved surmises that "the conditions of soil and water in Tanjore are "very similar to those in Bengal, and that the habits of the people contribute to keep up cholera in "their midst. They live on irrigated land. The country is wealthy, but the actual labourers are "very poor, and live in wretched hovels built on a damp porous soil." It is apparently taken for granted that these conditions, even if they were all, must remain permanent, and as a natural result the people must suffer. There is only one practical fact mentioned, and this is, that the water becomes green, foul, and unfit for use, especially in dry weather. But this view does not help us much, for we find that the rainfall in October, November, and December 1883 in Tanjore district amounted to above 27 inches, and, nevertheless, that in January 1884 no fewer than 7,688 people died of cholera. The fact is, we require to have the removable causes discovered and dealt with by skilled sanitary and engineering aid. Dr. Bidie has said, with perfect truth, that "the general death roll of the "Presidency will show how much has yet to be done to protect the people of Southern India from "epidemic disease, and that our efforts must not be confined to periods when sickness is prevailing, "but be continuous and systematic. Fortunately, too, the sanitary precautions which have been "found most effectual in warding off cholera are equally valuable for the prevention of other diseases."

In this statement the necessities of the case are fully recognised, and a great change would soon come over the public health of the Presidency if sanitary work in some degree corresponded to them.

11. *Small-pox.*—With the single exception of the famine year 1877, when there were 88,321 deaths from small-pox, the mortality in 1884, which amounted to 61,247, was the highest of 14 years. During the years succeeding the famine there was a reduction in the mortality, which sank to 0·5 per 1,000 in 1880 and 1881. In 1882 the rate rose to 0·6. In 1883 it was 1·3, or more than doubled, and in 1884 it was 2·1 per 1,000, against a previous five years' average rate of 0·7, or just one third.

All the districts, and 226 registration circles out of 229, registered small-pox deaths, but the number of villages affected had not been returned. Of 76 towns 65 yielded small-pox deaths, 4,063 in number, or 2·1 per 1,000 of the town population, the same rate as that registered in the districts.

12. The following were the monthly deaths :—

Months.	Small-pox Deaths.	Months.	Small-pox Deaths.
January - -	5,237	July - -	4,850
February - -	6,771	August - -	4,381
March - -	8,257	September - -	3,923
April - -	6,474	October - -	3,444
May - -	5,207	November - -	3,220
June - -	4,799	December - -	4,648

These deaths, according to age, stood as follows :—

Under one year	11,781
One and under 12 years	27,511
Above 12 years	21,955
Total	61,247

Dr. Bidie points out that nearly 64 per cent. of the year's loss from small-pox fell on ages under 12, while in Madras town the deaths of children under three years of age equalled 74 per cent. of the total deaths. The history as a whole leads to two conclusions: 1st, that there is a high degree of epidemic susceptibility to the action of small-pox, and, 2nd, that much improvement is required in the vaccination service.

Madras town and district had a small-pox death-rate of 9·8 per 1,000. But the highest district rates properly so called were those of Godavari and Kistna, respectively 6·8 and 6·1 per 1,000. Several of the town rates were very high. For example, Rajahmundry yielded a rate of 11·6, and Ellore 13·2 per 1,000, while Cochin, out of a population of 15,698, lost 364 by small-pox, or a rate of 23·1 per 1,000.

13. The vaccination establishment for 1884 stood as follows :—

Inspector of Vaccination and Deputy Sanitary Commissioner	1
First class Deputy Inspectors	33
Second „ „ „	15
First class Vaccinators	208
Second „ „	354
Probationers	110
Peons	48
Total	769

14. Including the probationers, there were thus 672 officials engaged in the actual work of vaccination, and the next abstract shows the year's results for the civil population (exclusive of military police, jails, &c.) :—

Population of circles and districts, 29,138,686.

Successful primary vaccinations,—

Under one year	103,114
One, and under six years	322,826
	425,940
Total, all ages	596,948
Successful re-vaccinations	3,291

These figures give 94·1 per cent. of successful primary vaccinations.

The general results for the country population were as follow during the last five years :—

Average annual successful vaccinations per 1,000	16·2
Average small-pox deaths per 1,000	0·6

The corresponding data for 48 municipalities were the following :—

Population	1,733,350
Successful primary vaccinations,—	
Under one year	25,715
One, and under six years	40,379
	66,094
Total, all ages	88,281

The five year's ratio of successful vaccinations per 1,000 in the municipalities was 41·1, and of small-pox deaths 1·4.

These data are no doubt approximately correct, and we can deduce from them what amount of protection was afforded to the population by assuming the registered births as approximately correct.

The facts would stand thus :—

Registered births	827,381
Vaccinations under one year of age	131,301
The birth ratio was	29·3 per 1,000
Vaccinations under one year	4·2 „

The vaccinations under one year were not much more than a seventh of the births, a fact which may in some sense account for the great prevalence of small-pox at the younger ages, which yielded not far short of two thirds of the mortality. The remedy suggested by the year's experience is that the Madras vaccination service should be directed to overtaking the births at ages under one year. But the great predisposition to small-pox epidemics in Madras Presidency must be met by strenuous endeavours to improve the sanitary condition of the population. The facts in the present Report show how small is the influence of vaccination in warding off small-pox when the predisposing epidemic causes are put on one side.

15. In Madras itself, Dr. Bidie says, "the disease was most destructive amongst children, and, as "might be anticipated, it raged with greatest severity in the most crowded and dirtiest quarters of "the town." This statement includes in a few words both the causes and remedies.

16. *Fevers*, like other death causes, bore evidence of the high susceptibility of the population to these causes during the year under review. The annual fever deaths registered during the last 19 years, if the registration had been all along equally reliable, would have proved a very large increase in fever mortality. Thus during the earlier years of the period the annual fever deaths may be estimated at about 110,000, but this was when registration was in its infancy. Since 1869, however, the fever deaths registered have been on the increase, and may have averaged double the record of the earlier years until the famine intervened and raised the fever mortality to the enormous number of 469,241 for the year 1877, and 374,443 for 1878. After the latter year the number of fever deaths registered declined year by year to 188,561 in 1882, and there is now a tendency to increase, for in 1883 there were 203,786 fever deaths registered, while in 1884 the mortality had reached 215,977 registered deaths. This number nearly averaged the previous five years' rate, which was 7·6 per 1,000, but this rate included the remains of the famine fever of 1877–78. All the districts and all the registration circles in them returned fever deaths in 1884. The number of villages attacked is not given in the returns, but it may be doubted if any of them escaped.

17. The lowest district fever rate of the year was returned from Tanjore. It was 4·9 per 1,000 only, marking apparently defective registration. Seven districts yielded rates exceeding 10 per 1,000. The highest rate of the year, 15·4 per 1,000, was returned from Kurnool district. All the 76 towns registered fever deaths, 8,850 in number, or 5·2 per 1,000, or about 2½ per 1,000 under the general Presidency rate. Only seven towns had fever rates of 10 per 1,000 and above. The highest rate of the year, 15·1 per 1,000, was returned from Vizianagram.

18. The following abstract shows the fever mortality for each month:—

Months.	Fever Deaths.	Months.	Fever Deaths.
January	20,816	July	18,414
February	15,864	August	18,530
March	14,958	September	18,218
April	14,166	October	17,930
May	15,398	November	21,088
June	16,248	December	24,247

19. The Report contains no information as to local conditions accompanying these fever deaths. Nevertheless, every attacked village and town could supply information. But still better would it be if the details already obtained were put to practical use. If village sites were drained and otherwise improved, villages, houses, and compounds cleansed, and their water-supply protected and improved, we might confidently expect reduction of these great and preventable death-rates. The measures required are purely practical, and our desire for information might admit of an answer that there had been quite enough reporting already, but far too little effective sanitary work.

20. *Bowel complaints.*—The registered deaths under this head were 28,775, or 1 per 1,000 of the population, the previous five years' average having been 0·7 per 1,000. The deaths were widely distributed, inasmuch as all the registering circles, with three exceptions, made returns of them. Of the total bowel complaint deaths, 4,201 were registered in the towns, which thus yielded a death-rate of 2·4 per 1,000, or nearly two and a half times that of the Presidency. There was a certain synchronism between the monthly deaths from bowel complaints and those from cholera.

21. *Injuries.*—Deaths so classed included 1,514 suicides, 861 from wounds, 6,837 from accidents, and 2,290 from wild beasts and snake bite.

22. *All other causes.*—The total mortality for Madras Presidency was made up of 650,335 deaths, and those entered under the present head were 257,358. A comparison of the two sets of figures will show how much improved registering work is still required to complete the disease history of the Presidency.

23. *European Troops.*—The strength of European troops serving in Madras Presidency on the 1st January 1884 was 10,774, and after making allowance for the year's additions and reductions, the strength on 1st January 1885 was 11,220.

The ratios from the usual inefficiency causes during 1884 were as follows:—

	Ratios per 1,000.
Admissions	1106·1
Daily sick	59·1
Deaths	8·5
Invaliding for change	20·9
Invaliding for discharge	11·4

The year's death-rate was the lowest on record and much below the average of previous years. The admissions, daily sick, and invaliding were also considerably under the average. "Fevers and "venereal diseases were the most common causes of inefficiency throughout the force."

24. There were 768 admissions to hospital from intermittent fever, of which one half came from a single station, Kamptee, which in times past has been the chief fever centre for Madras troops. A table in the report shows that during the last seven years there have been 12,497 admissions from intermittent fever at 20 stations, and of these admissions 3,010 were furnished by Kamptee alone.

25. The most fatal fever was enteric fever, from which there were 129 admissions and 18 deaths. Of the enteric fever cases, 60 were admitted at Bangalore, 39 at Secunderabad, and 15 at Kamptee. We are glad to learn from the present report that the foul water supply at Bangalore is at last likely to be abolished, after having been allowed to do mischief to the troops for a quarter of a century.

26. *Cholera* yielded 12 admissions and 10 deaths at Bangalore, Kamptee, Madras, Poonamallee, St. Thomas' Mount, and Secunderabad.

27. *Small-pox* yielded 19 cases, of which nine cases and one death were admitted at Bangalore. It is worthy of remark that while cholera gave rise to a death-rate of 2·6 per 1,000 among the whole civil population in affected and unaffected districts, the death-rate among European troops was under one per 1,000.

28. Admissions from venereal diseases show no tendency to reduction. The admission ratios for the last five years have been as follow :—

Years.	Ratio per 1,000 strength.
1880	256·2
1881	220·0
1882	257·3
1883	243·2
1884	256·1

These figures justify the conclusion of the Sanitary Commissioner that "all our efforts to improve "matters have been of no avail."

A 25½ per cent. admission-rate from these diseases appears to be the normal state of matters at present which may be contrasted with the 2½ rate among native troops.

29. The sick and death rates varied considerably at different stations of European troops. As usually happens, the highest and lowest rates were returned from small bodies of troops. For example, Mallapuram, out of a strength of 95, returned a death-rate of 31½ per 1,000, but there were only 3 deaths, only 1 of which was from zymotic disease, viz., fever. On the other hand, Bangalore, with a strength of 2,067, had only 8 deaths, or 3·8 per 1,000, and of the deaths 1 was from fever, 3 from cholera, and 1 from small-pox. Secunderabad, out of a strength of 2,386, yielded 23 deaths, or 9·6 per 1,000, of which 10 were from fever and 1 from cholera. The lowest death-rate of the year was yielded by Wellington, where out of 554 men 2 died, equal to 3·6 per 1,000. The highest rate of any large station was 16 per 1,000 out of 682 men, in Madras. Three of the 11 deaths there were from cholera. There is nothing in the present year's report to modify the estimate in previous ones of the relative sanitary condition of European stations. But, so far as can be judged of by the statistics, these bear evidence of steadily improving healthiness. As a general principle, improvements should be pressed forwards at the largest stations.

30. *Native Army.*—The total strength of the Native Army averaged 29,150, and the inefficiency rates were as follow :—

	Ratios per 1,000.
Admissions	749·2
Daily sick	32·8
Deaths in hospital	9·0
„ out of hospital	2·6
Invaliding	21·1

The strength present on which the stational statistics are based was 24,337. Out of this number, the deaths in hospital were 221 = 9 per 1,000. Of the deaths in hospital, 5 were from small-pox, 39 from fevers, and 29 from cholera. The highest death-rate of the year, 22·7 per 1,000, took place at Secunderabad, out of a strength of 3,388; but out of 509 men at Palaveram, while the deaths in hospital were 9·8, those out of hospital were 19·6 per 1,000. Of the Secunderabad deaths, 5 were due to fever and 22 to cholera. The health of European troops contrasts favourably with that of Native troops as regards death-rates. The admission and sick rates were both higher. But, in the case of fevers, the admission-rate of Native troops on an average of Native stations was 281 per 1,000 as contrasted with 179 per 1,000 for British troops. As regards the total admissions among British troops, which averaged 1,106·1 per 1,000, 256·1 were due to venereal diseases. Deducting these, the admission-rate for all other diseases would be 850 per 1,000, and, making a corresponding reduction for Native troops, their rate would remain at 717 per 1,000, not so great a difference for strangers in a sub-tropical country.

The apparently higher admission-rate among European troops does not, therefore, militate against the general improvement of Army health, but, when the facts are looked at in connexion with the

national statistics, it is easy to lay the hand on the defaulters, and to show where better work and more of it is required.

31. *Sanitary Reports (Military).*—Under this head are given 31 abstracts, sent to the Sanitary Commissioner from as many cantonments of British and Native troops.

Their nature is accurately described by the Sanitary Commissioner in the following words:—"These reports are mostly so perfunctorily drawn up, and the information they contain is so meagre, "that they are practically of very little use." They afford no information on the reasons why certain stations are more unhealthy than others, or on any remedies proposed for improving their sanitary condition. Current surface work is carried out, and this is so far well, but of really efficient sanitary improvements, it would not be easy to find a trace. We are, however, promised that "an "effort will be made to obtain more detailed and useful information for future reports." But except at certain unhealthy stations to which we have already referred, and where work of a different kind is required, there has been work done in surface cleansing, and surface drainage and water-supply, which has, no doubt, improved the general health of the Madras stations.

32. *Jails.*—The prisoners remaining at the end of 1883 numbered 7,437, and those at the end of 1884 were 6,596. Of the average prison population (7,017), 147 died of disease. In previous Memoranda we have given the yearly vital statistics, as affording the best guides to the state of prisons and prisoners, and we shall merely introduce the data since the famine and scarcity years 1877 and 1878, as follows:—

Years.	Ratio per 1,000.	
	Admissions.	Deaths.
1877	971·8	175·4
1878	944·4	125·4
1879	890·5	55·8
1880	854·0	44·7
1881	742·5	41·4
1882	800·4	41·9
1883	865·3	29·4
1884	769·5	20·2

These figures show a great and continuous improvement in the sanitary state of Madras jails, but, like all averages, they do not give an accurate idea of individual facts. There are still jails with very high rates, and these should be separately dealt with. So late as 1882 Trichinopoly Central Jail had a death-rate of 16¼ per cent., and one of only 1·74 per cent. in 1884. If we apply the epidemic test in 1884 this satisfactory conclusion is further confirmed. Thus the town cholera mortality was 5·3 per 1,000, and for the whole province it was 2·6, while the cholera death-rate in the jails was 0·9 per 1,000. The total loss of life from cholera was only 7 deaths, of which 5 took place in Cuddalore jail. But there were only 169 prisoners, and although the town itself suffered somewhat severely, the high jail rate marks the presence of local causes. The entire fever mortality in the jails was only 0·8 per 1,000. There were 1,389 fever admissions, but only 7 deaths. The corresponding fever mortality for the civil population was 7·6 per 1,000. There were 14 cases and 2 deaths from small-pox, or 0·2 per 1,000, or just a tenth part of the civil rate. Our object in introducing these comparisons is simply to call attention to the fact that 7,000 inhabitants out of the population of the Presidency have had their sanitary surroundings so improved as to have nearly escaped epidemics, showing that the work of improvement is a practicable one, and to raise the question why it is that the remainder of the population not in jails suffers so greatly, and why so little effort has been made to improve their sanitary surroundings also?

33. In comparing the vital statistics of the civil population with those of fixed bodies of men some allowance must be made for inaccuracies, but after making every allowance the question raised by the following figures must be answered, the differences accounted for, and these must be shown to be permanent and irremediable by any Government intervention, or they must be removed if reproduced in successive years.

Death-rates per 1,000, 1884:—

Diseases.	Civil Population.	Native Army.	Prisoners.
Cholera	2·6	1·2	0·9
Fever	7·6	1·6	0·8
Small-pox	2·1	0·2	0·2
Total epidemic deaths	12·3	3·0	1·9

These figures contain the year's epidemic results of the sanitary administration of Madras. The facts are taken from the Sanitary Commissioner, whose duty it is to report the annual losses from preventable disease, which it is the duty of the sanitary executive, if there be such a thing, to remove.

14. *Municipalities.*—There are 28 municipalities in the Presidency of Madras, under their own local Governments. Their aggregate population in 1884, including Madras town, was 1,743,350. The births registered in 1885 were 55,152, or 31·8 per 1,000 of the population, and the deaths registered were 58,989, or 34 per 1,000. The deaths were attributed to the following causes :—

	Deaths.
Cholera	7,172
Small-pox	7,689
Fevers	10,668
Bowel complaints	6,464
Injuries	550
All other causes	26,446

The death-rates in these towns have been as follows for the last five years :—

	Per 1,000.
1880	26·6
1881	28·1
1882	28·0
1883	30·0
1884	34·0

The death-rates are rising instead of falling, and if the registered deaths are approximately correct, the proper expression to adopt is that the municipal authorities are shown by the figures not to have done their duty efficiently.

35. As regards their proceedings, the Sanitary Commissioner informs us that "no new work of an "important nature was undertaken during the year." . . . "All that was done consisted, as "usual, in the repairing and cleansing of tanks and wells, and in the repair and construction of "latrines, drains, roads, dustbins, markets, slaughter-houses, &c.," all of them useful and necessary works, but the year's epidemic experience shows that something more is required.

36. As regards actual sanitary condition, the following summary by the Sanitary Commissioner is of importance :—"The sources of water-supply were the same, chiefly tanks and wells, and in some "municipalities rivers and irrigation channels. Year after year greater attention is paid and care "taken to conserve and preserve the sources supplying drinking-water from pollution. Generally "speaking, there is no system of drainage. The existing drains chiefly consist of side cuttings for "surface drainage only. In some towns, however, pucka masonry drains exist. Cesspools abound, "and drainage from houses flows into these, or into backyards, or into the streets, or into the side "cuttings. The system of conservancy was the same as last reported. The street sweepings, other "refuse matters, and contents of latrines and dustbins were removed daily by scavenging establishments, "maintained for the purpose, and carted away beyond municipal limits, and disposed of as usual, either "by burying in trenches, being thrown into fields, sold as manure, or consumed in cinerators."

37. The staff and material employed (excluding those of Madras city) is stated as follows :—

Establishment.	Number.	Material.	Number.
Inspectors	111	Carts	1,024
Overseers	34	Dustbins	4,428
Maistries	71	Public latrines	922
Peons	185	Private latrines	17,131
Sweepers	3,189		
Tank watchers	109		
Total sanitary staff	3,699	—	—

We must, however, repeat the facts already stated, that this staff does sanitary work for 27 towns, excluding the capital, and is intended to supply the wants of 1,327,502 people.

The work done includes the cleansing of 17,131 private latrines, which apparently marks an important advance in sanitary procedure. As the Sanitary Commissioner remarks, private cleansing of this kind, if generally adopted, "would enable municipal servants to obtain access into the interior "and backyards of dwellings, and by this means the cleansing of compounds and inside of houses, "where proper conservancy is most needed, will, it is hoped, be gradually effected." But from what has been already quoted from this Report, it will be seen that the main disease causes are those connected with the fouling of subsoils by cesspits and want of drainage, and the consequent fouling of wells in these places. All the surface cleansing that can be done will not affect materially the conditions of the problem. What is really needed is house drainage and the total abolition of cesspits, and in absence of these fundamental sanitary improvements we must expect the recurrence of epidemic outbursts among the people.

38. The following was the expenditure for sanitary purposes in 47 municipal towns (excluding Madras), the population amounting, as already stated, to 1,327,502, and the staff and material of which has been already enumerated; it will be seen that the last completed year ended in March 1884, and that the returns for the same year were for nine months only.

	1883–84.		1884–85.	
	Amount sanctioned.	Amount spent.	Amount sanctioned.	Spent in Nine Months.
	Rs.	Rs.	Rs.	Rs.
For conservancy	363,476	357,865	378,939	273,576
Improving town sites	44,656	50,196	36,285	18,676
,, water-supply	45,613	44,009	67,097	42,133
For fairs and festivals	3,010	3,826	6,935	2,494
Markets and slaughter-houses	24,688	17,962	20,074	11,842
Other sanitary objects	89,756	68,286	35,206	36,030
Total	571,199	541,644	654,536	384,751

The whole amount sanctioned for the year 1884–85, if it were spent, would be about a shilling a head of the population, apparently a very disproportionate sum for the whole sanitary improvements of a year. The conservancy part of it would be a little over sixpence a head. Small and unsatisfactory as the advance has been, still as compared with past times the Sanitary Commissioner considers that there has been advance. "On the whole," he says, "it may be said that of late "sanitation has made some progress in municipal towns. Much remains to be done, and there is "ample room for improvement," but there is reasonable hope for the future. The main danger with the new municipal authorities is their passing into a wrong groove. We have stated what the local epidemic causes in these towns are, and where they are to be found. They include efficient compound and house cleansing, and, without in the slightest degree detracting from the importance of really efficient surface work, it may be safely said that no amount of this work will compensate for the subsoil pollution caused by house cesspits and the sinking of sewage from the surface into the subsoil. This must be put an end to either by house or town drainage, or by removing the whole town sewage solid and liquid daily by hand labour.

39. The Report contains abstracts of 41 municipal and other town reports which fully bear out the general conclusions we have quoted from the Sanitary Commissioner's Report. It is not necessary to refer to them individually, as the same general principles of improvement are applicable to all of them. If there be an exception it is that of Guntur in Kistna, about the only town in Madras which has had the service of a zealous and active municipality. Of its water-supply, drainage, and conservancy, it is stated that "it is very well off in these respects. Its water-supply is excellent and well taken care "of, drainage good, and conservancy efficient." In the ante-municipal days this town of 19,646 inhabitants was a hotbed of cholera. But since it has been improved on lines strictly applicable to every similar town in India cholera has ceased to infest it. The five years' death-rate of this town had been 16·3 per 1,000, but it had an added rate of 2 per 1,000 from a smart attack of small-pox; it had no cholera, although Kistna district, in which it is situated, yielded 1,561 cholera deaths. The same district had 10,386 small-pox deaths, or 6·7 per 1,000 of the population, while Guntur town escaped with 46 deaths, or 2·3 per 1,000. It may be further stated that Kistna fever-rate was 9 per 1,000, while the Guntur fever-rate was 4·2 per 1,000. We have here an instance of good sanitary work carried out for a number of years, attended by so very marked a diminution of its epidemic death-rates as to justify our advising for another year that its example should be followed.

40. The sanitary establishment and outlay for this town of 19,646 inhabitants was made up of—

4 overseers.	25 carts.
4 peons.	65 dustbins.
35 sweepers.	18 public latrines.
25 public totties.	4,000 private latrines.
4 private totties.	4 tank watchers.

From the way in which the accounts are made up, we have only the amounts expended for nine months ending with December 1884. The estimated income for the whole year, we presume, was Rs. 31,380, and out of this aggregate the outlay for nine months was as follows:—

	Rs.
Conservancy	5,870
Improvements in wells	146
Other sanitary work	110
Total	6,126

If 25 per cent. be added to this total for the other three months the whole year's expenditure for sanitary work, the efficiency of which has been proved for years by its results, would be in round numbers 765*l.*, or little more than 9*d.* per head.

Taking the experience of Guntur, as it has been given in the present and in previous Reports for years past, it appears to show that the sanitary improvement of these Indian towns does not depend so much on the outlay, as it does on the zeal and efficiency with which the work is carried out and superintended by the municipal authorities, and hence it throws some more light on the nature of these improvements in sanitary administration which are so much needed in Madras Presidency.

41. *Local fund circles.*—The most important of all sanitary work in India is that which must be done in these circles, for it is in them that Indian epidemics take their origin and find most of their victims. The number of local fund circles in 1884 corresponded to the number of districts, excluding Madras, so that they were 21 in number; they contained 52,003 villages, and these villages formed the population centres of the entire rural population of the Presidency, which in 1881 numbered 28,109,869 individuals.

The total available income of the year for the local wants of this great population was one third of the land cess amounting to Rs. 1,402,971, in round numbers 140,000*l.*; of this sum 39,967*l.* was allotted for sanitary purposes for the financial year 1883–84, and 30,828*l.* was spent. The allotment for the next year 1884–85 was 37,294*l.*, and the expenditure for the last nine months was 19,745*l.* The completed year's expenditure was only a little more than a farthing per head of the population.

42. The objects on which sanitary expenditure was incurred during the completed year, with the amounts allotted and expended, stood as follows:—

	Whole Year 1884–85.	
	Amount sanctioned.	Amount expended.
	Rs.	Rs.
Conservancy	163,006	154,985
Village sites	40,080	15,611
Water supply	84,581	68,168
Fairs and festivals	10,971	8,839
Markets and slaughter-houses	58,063	26,725
Other sanitary objects	43,016	33,965
Total	399,672	308,288

The medical statistics of district populations have been already discussed. There is no special account of village sanitary conditions, but under the head of "sanitary works" the Sanitary Commissioner states that "they consisted chiefly in the sinking of wells and excavating tanks, in the "erection of latrines and dustbins, improving and repairing drains, cleansing tanks and wells, "removing rank vegetation, improving village sites, &c. Except in a few Cusbah towns, where "some stone drains exist, the drainage is mostly very primitive, consisting of ditches cut in the soil "in the sides of the streets and thoroughfares, and house drainage either flows into these, into "cesspools, or into the backyards, where it sinks into the soil. . . . Out of a total of 52,003 "villages only 565 were conserved, against 576 in 1883."

43. We have placed these two statements side by side to show the points in which existing sanitary necessities are not met by the expenditure, but it is satisfactory to know that something has been done in the way of legislation at least to meet these deficiencies by the Madras Local Boards Act of 1884, which "provides for the prohibition and removal of obstructions, and the cleansing of tanks, "streams, wells, and unwholesome buildings and lands in all rural areas," and the Sanitary Commissioner expects "that greater attention will be paid to village and town sanitation" under the powers conferred by it. But the great want in all villages is cleansing and keeping clean, provision of suitable accommodation for cattle to enable them to be removed from compounds and houses, closing all cesspits and bad wells of houses, and providing village water supplies. Although the Sanitary Commissioner does not include these all important points in his statement, we must hope that they have not been overlooked.

44. A further step was taken in the year 1883 in constituting zillah and civil surgeons, district medical and sanitary officers for their respective districts, "to inspect, as frequently as is consistent "with their other duties . . . . the conservancy establishments of their districts, especially of "the larger towns and villages." We must not forget, however, that the utility of all such inspection work has to be gauged not by the amount of it, but by what comes of it.

45. No amount of inspectors' work can either cleanse or drain a village, or give it good water. To be of use, we must fully acknowledge that the inspector can never be more in public health administration than the immediate forerunner of the executive sanitary officer, for it is he, and not the inspecting officer, whose duty it is to remove disease causes and save life.

46. *General remarks and personal proceedings.*—There is not much information under this head, apparently due to change in the office of Sanitary Commissioner. The chief interest lies in the account given in Dr. Furnell's appended report, already referred to, on the result of an inspection made by him into the causes of cholera in Tanjore district, which he concludes has been mainly due in past times to bad and deficient water supply.

The facts he mentions leave no doubt that the water is both bad and deficient, and we are glad that the Collector has been desired by the Government "to give the subject his immediate and close "attention. But it by no means follows that we concur with Dr. Furnell's view of the special causative relation of impure water to cholera epidemics. The bad water is always there—the cholera not always. Bad water is simply one of the predisposing causes of cholera, but there are others which may be left to do their deadly work when the bad water has been dealt with, and, as an important

contribution to the discussion of this matter, we shall here introduce the following table, with which the Report is concluded :—

Return showing the Deaths from Cholera in the Town of Madras from 1855 to 1884.

Years.	Deaths from Cholera.	Years.	Deaths from Cholera.	
1855	1,956	1870	861	
1856	805	1871	493	
1857	1,378	1872	5	Red Hills water supplied.
1858	1,965	1873	6	
1859	982	1874	—	
1860	2,580	1875	879	Famine years.
1861	2,776	1876	2,035	
1862	3,635	1877	6,246	
1863	1,684	1878	64	
1864	574	1879	34	
1865	944	1880	2	
1866	2,984	1881	126	
1867	514	1882	441	
1868	13	1883	168	
1869	568	1884	269	Up to 31st July, 1884.

47. Taken as a whole, the figures show a large reduction in the cholera mortality since the Red Hills water was brought into Madras. The great increase apparent in the so-called famine years in this table was, however, part of one of the greatest cholera epidemics on record, which extended over a large area of India, and the fatality from cholera in the town itself was due in great part to the influx of a vast number of starving people, and to great increase of all sanitary evils (for these were not dealt with) consequent on the overcrowding. The facts rather would seem to show that, while in former years the predisposition to attacks of cholera was augmented by the use of foul well water, this special cause ceased to operate when the purer water-supply was introduced, but that other unremoved causes were left to become active when epidemic increase came round. It ought to be stated at the same time that the end of 1876 and 1877, and not 1875, constituted the famine period.

48. Considering that Dr. Bidie had only entered on his work, he has drawn up a very instructive and useful Report for the year. It would, of course, have been more satisfactory if he had been able to report a sufficiency of good work, well done, and life saved. It is, at the same time, not too much to state that in Madras, as in other parts of India, the work of disease reporting has been long since completed for all practical purposes, and that what is now required is skilled sanitary action on the information already in our possession. So far as we can judge from the present Report the great desideratum in all municipalities and local fund circles is appreciation of the importance of our present knowledge to the health and prosperity of the people, for it can scarcely be supposed that, if local authorities realized the fact that death and disease rates tell us not only how many people die of epidemics but how many have their working power permanently injured, and with it the means of earning a living for themselves and their families, that the present inaction would continue. We have instanced the case of Guntur, as showing how much can be done by persistent and intelligent use of known and simple sanitary methods at a cost of 9*d.* a head of the population per annum, and the Report shows how much less had been done by the other municipalities by an outlay of a shilling a head.

49. Neither the municipalities nor the local fund circles had even spent the sums allotted to them for public health purposes, and it is most satisfactory to see that the Government has taken up this matter, for in their Resolution on the Report under review they say, "This result is more "disappointing even than that of last year, and the special attention of chairmen of all municipal "councils will now be drawn to the necessity of great attention being paid to the judicious "expenditure of all the municipal sanitary allotments within the year." And referring to the same falling off in local fund circles they continue, "It is very unsatisfactory to observe that the "retrograde movement noticed in the last year's Report has continued. This is due in most cases "not to insufficiency of allotments, but to the allotments made not being sufficiently utilized. "Presidents of all local Boards will now be called on specially to report how far in the current year "they expect to be able to utilize their sanitary allotment, and to give full reasons in cases where "they report that they do not expect to be able to spend all the funds allotted for sanitation."

50. This action of the Presidency Government involves a principle of the greatest importance in sanitary work. India has not yet obtained the advantages of an efficient sanitary administration while professing to do sanitary work. Up to the present time the proceedings may, without detracting from their importance, be considered as mainly tentative, and while powers have been conferred on local authorities, it is necessary that these authorities should realize the fact that power has been conferred, not to be kept, but to be used for the common good. The evidence in the report under review, so far as it goes, is sufficient to show that there need be no fear of the necessary outlay for sanitary work pressing heavily on the towns and villages. What is more required than money is simply energy and effective action, and we hail this step of the Madras Government in calling the local authorities to account as a decided advance towards better administrative arrangements.

10th April, 1886.

No. 3.

MEMORANDUM of the ARMY SANITARY COMMISSION on the REPORT of the SANITARY COMMISSIONER of the GOVERNMENT of BOMBAY for 1884.

1. In conformity with present practice, this Report deals exclusively with the sanitary condition of the Civil population of Bombay Presidency. But at the same time it contains a brief enumeration of sanitary works carried out in the course of the year at military stations.

2. On the 1st July 1884, an important change in the registration arrangements was made, whereby the compilation of vital statistics was vested solely in the Deputy Sanitary Commissioner and his officers, "who is thus brought each month into direct communication with every village in his "district."

We may hope that this arrangement may ensure greater accuracy and despatch in the work of compilation, and, what is of more importance, that it will keep the Sanitary Commissioner fully informed as to the state of the villages, and enable him to give information and advice on any preventive measures required, especially against epedemic diseases within his district. In the advance and improvement of Indian registration considerable delay has taken place in arriving at the facts for practical use, and it may show the importance attached to having immediate information during epidemic seasons in London that during cholera epidemics it was the custom to publish a daily list of cholera deaths, with their residences thus enabling local measures to be at once applied. What has been done in Bombay has thus been a step in the right direction, provided executive measures are made to correspond with it.

3. The registration districts were also re-arranged, and the result so far has been satisfactory. "The new arrangement has been found to work admirably, as the statistics are now received from "the villages with much greater punctuality than formerly." This has been, no doubt, partly due to the fact that the areas of the new districts have been made conterminous with collectorates, in which the same language is spoken. In the western and central districts there are nine collectorates in which the language is Marathi. In the southern district there are four collectorates in which Kanarese is spoken. In eastern Gujarat the language is Gujarati in five collectorates, and there are five collectorates in Sind district where the language is Sindi. The city of Bombay has its own registration arrangements.

4. The entire population of the Presidency from which returns of births and deaths are now received amounted in 1881 to 16,464,414. The birth-rates for a series of years have been as follows:—

Ten years mean.	Rate per 1,000.
1874—1883	22·61
1883	30·50
1884	32·50

There has thus been a considerable increase in the numbers registered, although the latest returns are still below what ought to be the real rate.

Out of 24 collectorates, including Bombay city, the lowest rate, 16·91 per 1,000, in 1884, was returned from Hyderabad, and Bombay city only returned a rate of 18·59 per 1,000. The highest birth-rate of the year was returned from Dharwar. It reached 43·43 per 1,000, which may be contrasted with the registering work done in Bombay, while this, besides falling far below the average rate for the Presidency, is marked by great irregularity in different years. It is probable that none of the rates are absolutely correct, but the tables show that, as a whole, the birth registration is advancing towards accuracy, and that steps ought to be taken to improve registration in Bombay, which is at present the most populous city in India, and one in which registration of births ought to be better done.

The actual numbers of births registered for the entire Presidency in 1884 were:—

Of males	278,986
Of females	255,737
Total births	534,723

5. *Deaths.*—The deaths registered in 1884 were:—

Of males	214,376
Of females	194,033
Total deaths	408,409

equal a rate of 24·82 per 1,000, obviously far below the true rate of a population not only unhealthy, but subject to violent epidemic outbreaks and other death causes, as, for example, the famine experience

of 1877–78, during the first year of which the registered deaths were 627,708, and during the second 532,951. During the last five years the death registration, but not necessarily the mortality, has stood as follows :—

Years.	Registered Deaths.
1880	328,673
1881	381,450
1882	343,418
1883	420,198
1884	408,409

This table only shows that the registration of deaths, like the registration of births, has been improving in the Presidency as a whole, but an examination of the district rates shows that the existing defects are not general. The Sind registration in 1884 only returned an average death-rate of 17·27 per 1,000, while the other districts yielded results much nearer the true rates. The best registered district was the southern, which returned a rate of 31·04 per 1,000, still, however, below the truth. The city of Bombay had a death-rate of 28·82 per 1,000, which is much nearer the truth than its birth-rate. Taking the collectorates separately, the registered death-rates lay between 15·55 per 1,000 for Thar and Parkár, and 35·15 for Broach, marking the relative efficiency of registration in each. Under the new arrangements it is not impossible that these extreme ratios may be more equalised.

6. Under present conditions, of the registered deaths 45·07 per cent. were returned under five years of age. But this is a scarcely reliable ratio, and when compared with the rates at ages above five, it would appear as if the registration were most defective in the higher ages. This is all that the figures warrant us in stating.

7. The death causes, according to the classification in use, were the following :—

Diseases.	Numbers.	Ratio per 1,000 of Population.
Cholera	13,804	·84
Small-pox	14,438	·88
Fever	276,989	16·83
Bowel complaints	35,283	2·19
Injuries	5,570	·34
Other causes	61,625	3·74
All causes	408,409	24·82

This table shows that the least fatal epidemic of 1884 was cholera, and the most fatal fever.

8. *Cholera* prevailed during some part of the year over the whole country, but its incidence was very irregular. In the western districts, including Bombay city, the disease showed itself as a distinct outbreak in the earlier months, to be followed by a partial subsidence in the middle of the year, and then an increase towards the end of the year. In the eastern districts the epidemic existed in force in the middle months of the year. In the central districts the deaths were more scattered, but were most numerous towards the end of the year. In the southern districts the epidemic was severe on and after June, and in the Sind districts there was no cholera till October. In each of the registration divisions the epidemic appeared to follow a special time prevalence, and there was no apparent law of extension or continuity of the epidemic. There are in all 24 separate registration districts, and cholera appeared in greater or less prevalence in all of them; but many of the registration circles in these districts escaped the disease, for out of 283 circles, 157 yielded all the mortality. The village returns exhibited the usual anomalies, for the whole cholera mortality of the year was returned from 1,417 villages out of 24,536 in the Presidency. The towns suffered more proportionally than the villages, for out of 62 there were deaths from cholera returned by 33.

9. We have no means of ascertaining the exact ratio in which cholera prevailed in the attacked villages. These yielded in all 11,684 deaths, or about eight per village. Taken over the whole country population, the cholera death-rate was 0·81 per 1,000. The highest death-rate of the year was 5·27 per 1,000 of population in Dharwar, but it was yielded by 424 villages out of 1,281, so that in this case, at least, the rate would have to be multiplied by three, which would bring it up to 15·82 per 1,000 for the attacked villages. It is very important to the true understanding of the problems to be dealt with that this point should be borne in mind, for it shows that a low general rate may really mean great loss and suffering among a circumscribed population.

In the towns there were 2,120 cholera deaths, or 1·01 per 1,000 of the whole town population; but of these deaths Bombay city yielded 568, and Hubli in Dharwar 466, or about half the whole town mortality between them.

10. The monthly prevalence of cholera was as follows:—

Months.	Cholera Deaths.	Months.	Cholera Deaths.
January	207	July	2,738
February	119	August	2,746
March	414	September	1,665
April	337	October	1,626
May	556	November	1,100
June	1,705	December	556

From the history already given, it will be evident that this table gives the year's facts, but not the monthly epidemic history, because the months of greatest prevalence, June to September, were past before the Sind epidemic took place.

11. In previous memoranda, we have given the annual cholera mortality of Bombay city during a series of years as part of the epidemic history. It is unnecessary to repeat the data at present, but we can place a general statement of the facts for a period of 36 years alongside the sanitary history of the Presidency capital. It happens that these 36 years divide themselves into two classes of 18 years each. The first section comprehends the years 1848 to 1865 inclusive, during which there was little sanitary work done in any part of the Presidency. The second section includes 16 years from 1866 to 1883 inclusive, and contains the years not only of sanitary work, but of increasing registration of deaths, during which a much larger proportion of the mortality has been reported in the city.

During the first series of 18 years there were 40,341 cholera deaths reported, and during the second 18 years the registered cholera deaths have been 9,343. There are, no doubt, errors in both series of numbers, but, on the other hand, cholera is a well known disease among the people, and, making allowance for some error, we have certainly the fact that since sanitary work has been in some sense done, the cholera deaths have fallen to one-fourth part of their previous numbers.

The average deaths in Bombay City for the whole period of 36 years has been 1,380 per annum, and in 1884 its greatly increased population had only 568 deaths from the epidemic, a number still far above what the mortality of the year ought to have been.

12. Taken over the whole Presidency, the cholera mortality of 1884 was 0·84 per 1,000, a shade under the preceding five years' average, which was 0·85 per 1,000.

The deaths actually registered in the same years were:—

1879	6,937	1882	7,904
1880	684	1883	37,954
1881	16,694	1884	13,804

As we have compared the deaths for two series of years from cholera in Bombay city, we may give the results for two series of nine years each for the Presidency as a whole:—

Years.	Deaths from Cholera.
1866 to 1874	111,296
1875 „ 1883	253,840

If the reduction of city deaths to one-fourth may be fairly assumed as marking the progress of sanitary improvement, what conclusion can be drawn from the cholera history of the Presidency, or rather of the country villages, in which the cholera mortality of recent years has considerably more than doubled, except that the localizing influences in the villages have increased in intensity, while those in Bombay city have notably diminished.

13. What these influences are is quite well known, and they have almost ceased to be made subjects of remark in local reports. There are, however, a few facts stated by Mr. Hewlett which may be quoted. The village of Karjat is more frequently affected with cholera than any other part of the Thana collectorate, and the disease clung persistently to it and to a neighbouring one. The reason appears to be a topographical one, and is described as follows:—"The infected portion of Karjat rests "in a valley running irregularly north and south for some seven or eight miles, and varying in "breadth from one to three. The lower ground is fertile and is extensively sown with rice, a crop "requiring much water for its cultivation. The atmosphere is oppressively warm, moist, and still. "Through the valley flows the Dhawali river, a clear bright stream, from which the villages derive "their chief water-supply. Numerous small villages are scattered up and down through the valley; "many of them have suffered severely." Similar conditions are described as existing at Dahivali village of 1,239 inhabitants, among whom where 37 cholera deaths, of which "all but two occurred "among the population inhabiting a low lying row of huts on the western border of the village. The "ground here is damp, whereas the eastern and central parts of the village are raised and consequently "drier." This locality, which is about a fifth part of the village, yielded all the deaths.

The disease in Bettigeri in Dharwar was almost entirely confined to low caste people living in the poorer quarters of the town, on the edge of "the filthy Landy Nala."

In the Bombay city most of the fatal cases take place among people using the city water, a fact which proves that good water *per se* is no protection against cholera. But in 1884 there were groups of cases among people using well water. The officer of health says, that he found in three of the

well waters "organisms of a most suspicious type." A description scarcely sufficient for any etiological purpose.

13. The deaths in Bombay bore so high a ratio to the attacks that the Government ordered an inquiry. The Surgeon-General was of opinion that the attacks were under-estimated, but Mr. Hewlett considers the high mortality due in part, at least, to removal of cases to hospital over long distances. As this view has been called in question in the Government resolution, it may be well to state the principles which ought to regulate removal as these have been determined by past experience.

14. There are diseases, especially epidemic cases, and accidents in which the patient has to struggle for life, and the question whether he may have a better chance of recovery by care on the spot or by removal to a distant hospital depends on the state of the case. The experience of cholera in England during 1848–49 was that the mortality in hospital cases was determined by the distance to which patients had to be moved, and hence the sanitary rule that in certain cases epidemic attacks are treated with least danger to life on the spot, and that it is better for all parties to remove the healthy if necessary; and any way that during epidemics it is safest for the patient, whose interest is the one to be considered in such cases, to have the required hospital accommodation as near his residence as possible. This is not so difficult a matter as at first sight appears, because epidemic localities are well known, they are few in number, and the attack is limited as to time. We shall recur to this matter again.

15. In the absence of local information as to the sanitary state of affected villages, it may, nevertheless, be stated generally that the history of cholera during the last 18 years, already given, shows that this epidemic disease either has increased in intensity, which is scarcely probable, or that the susceptibility of the population to cholera epidemic attacks has increased, and as we know that the local intensity of all epidemics is influenced by local conditions, we arrive at the conclusion that the future safety of the people depends on the extent to which efficient sanitary work is done or neglected to be done. What the rural districts require is an efficient sanitary executive.

16. *Small-pox.*—Bombay Presidency has had an efficient vaccination service for many years, and we should expect to find proof of its preventive agency in the statistics of small-pox mortality. In former memoranda we have discussed this subject, and we shall here introduce the following tabular statement of vaccinations and small-pox deaths, which, as will be seen, contains facts on both sides of the question:—

Years.	Primary Vaccinations.	Small-pox Deaths.	Years.	Primary Vaccinations.	Small-pox Deaths.
1873	—	2,935	1879	561,969	1,155
1874	—	3,903	1880	586,501	940
1875	671,817	3,461	1881	642,505	539
1876	699,639	11,817	1882	229,323	1,690
1877	732,184	27,369	1883	792,206	13,404
1878	670,055	4,475	1884	826,965	14,488
Total	2,754,695	60,960	Total	4,139,469	32,107

At first sight this abstract appears to show a falling off in small-pox mortality to little short of one half during the last six years, but it has to be remembered that the years 1877–78 were the famine and scarcity years, which, in Indian experience, are years of high small-pox mortality; nevertheless, all the years in the second column, except the two last, show a large reduction in the deaths over the years of lower mortality in the first column. But at this point we are met by the fact of increasing small-pox mortality in 1883–84.

If we take the last three years it would seem that an epidemic of small-pox was in progress in the face of the vaccination.

17. The following abstract of monthly deaths shows the facts for 1884:—

Months.	Small-pox Deaths.	Months.	Small-pox Deaths.
January	1,835	July	812
February	2,211	August	500
March	2,413	September	328
April	2,364	October	260
May	1,856	November	223
June	1,387	December	309

The months of highest mortality were nearly the same over the districts thus affording additional evidence of epidemic prevalence, and this was general, as is shown by the fact that small-pox deaths were registered in all the districts and in 234 out of 283 circles of registration. But the whole mortality took place in 3,072 villages out of 24,536. The disease prevailed in 39 towns out of 62. The town death-rate was 0·58 per 1,000, and the country rate 0·92 per 1,000. The small-pox death-rate for the whole Presidency, which had been 0·21 per 1,000 as the mean of five preceding years, was raised in 1884 to 0·88 per 1,000, or about fourfold.

18. The highest death-rates of the year, lying between 2·82 and 3·10 per 1,000, were returned from the southern registration district, which includes Belgaum, Dharwar, Kaladgi, and Kanara, and it is worthy of remark that this same district returned the highest rates of the year from cholera but not from fever, which, as we shall see, was not an epidemic in 1884. We have already seen that the total deaths from small-pox in 1884 were 14,438. Of these the deaths registered as under one year of age were 3,723, and between one year and 12 years there were 5,423 deaths. Above 12 years of age there were 5,292 deaths registered, thus about two thirds of the years' mortality took place at young ages, and one fourth under one year of age.

19. We shall next trace briefly the relation of small-pox mortality to vaccination in 1884-85. The staff was as follows:—

Deputy Sanitary Commissioners	5
Superintendents of Vaccination	3
Inspectors of Sanitation and Vaccination	31
Assistant Superintendents of Vaccination	5
Clerks and karkuns	29
Vaccinators, all classes	477
Peons	502
Total staff	1,052

Of this staff 152 vaccinators and 158 peons are employed in Native States; so that in discussing the question it must be borne in mind that while the registration of deaths only includes a population of 16,503,663 within British territory, the vaccination service covers not only this population but an additional 9,111,865 in the Native States.

The children born in British territory in 1884 and registered amounted to 534,723, but 97,143 of them died under one year of age, leaving at that age 437,580 available for vaccination.

The actual numbers successfully vaccinated under one year of age were 328,646, and between one and six 155,393. In round numbers, therefore, about three fourths of the children available for vaccination under one year of age were successfully vaccinated in 1884.

20. In the preceding table we have placed side by side the vaccinations and small-pox deaths for a period of 10 years, with the result that, while 6,904,464 primary vaccinations were performed, 79,229 persons died of small-pox, or about one death for every 90 primary operations. But, as already stated, the vaccinations include those done in the Native States, which in the last year of the series amounted to between 90,000 and 100,000.

The conclusion from these years of experience appears to be that, while there is evidence of a large saving of life from vaccination, and no doubt of a corresponding reduction in the results of small-pox attacks which are not fatal, the disease is nevertheless liable to periodical epidemic increase, which can only be met by more active sanitary work in the towns and villages.

21. *Fevers.*—Deaths under this head were returned from all the registration districts, from all the circles of registration, from all the towns, and from 22,441 villages out of 24,536. Fever was thus generally prevalent over the entire Presidency.

22. The following table, abstracted from the Report, shows the monthly fever mortality for a series of years.

Months.	Fever Deaths Registered.		
	Mean of 10 Years, 1874 to 1883.	1883.	1884.
January	22,664	23,513	23,510
February	19,393	21,114	20,290
March	20,540	22,669	22,096
April	19,751	22,885	20,469
May	19,595	20,512	20,673
June	18,259	20,700	19,498
July	20,944	23,106	18,902
August	23,543	26,703	22,273
September	23,133	30,755	23,462
October	23,697	29,144	27,767
November	23,745	26,587	31,512
December	25,207	25,153	28,537
Total	263,385	296,741	276,989

These facts show clearly that the deaths registered under the head of fevers are on the increase. The fever-rate for the whole Presidency in 1884 was 16·83 per 1,000, and for the previous five years it was 16·09 per 1,000. The rates in 1884 varied between 8·06 per 1,000, the lowest rate, in Ratnagiri district, and 28·72 per 1,000 in Broach, which was the highest. The town fever-rates varied much more than the country rates. They ranked between 3·99 per 1,000 in Kaladgi town, and 42·60 per 1,000 in Virangam, where, out of 18,990 people, 809 died of fever.

The general town fever death-rate was 13·83 per 1,000, and the rate for the districts 17·27 per 1,000, and, as already stated, the Presidency rate was 16·83 per 1,000.

The information about fevers is confined to the year's statistics, and does not include local causes.

23. *Bowel complaints*, chiefly diarrhœa and dysentery, yielded a death-rate of 2·19 per 1,000 for the towns and districts, and of course the same rate prevailed over the Presidency in 1884. The previous five years' rate was 1·77 per 1,000. The deaths under this head were 35,983. They were returned from all the districts, from 273 out of 283 registration circles, and from 7,140 villages out of 24,536. The attacks were most fatal in the latter months of the year, as the following abstract shows :—

Months.	Bowel Complaint Deaths.	Months.	Bowel Complaint Deaths.
January	2,728	July	2,938
February	2,149	August	3,823
March	2,821	September	3,849
April	2,409	October	3,732
May	2,569	November	3,530
June	2,556	December	3,384

By comparing this table with a preceding one showing the monthly mortality from cholera, it will be found that there is a correspondence in the periods of increase of both diseases. The bowel complaints appear to have increased at the same period as the cholera, but the augmentation does not appear to have assumed the epidemic character. It was general over most of the province, but Sind suffered least. During the six years following 1872 the annual mean mortality from these diseases was 37,091 deaths, and during the next six years, ending 1884, the mean has been 30,128 deaths, showing a large reduction in the rate. It is worthy of remark that the same districts which suffered most from cholera, Belgaum and Dharwar, were those which yielded the highest death-rates from bowel complaints, namely, 5·43 and 5·23 per 1,000.

24. *Injuries.*—There were 5,570 deaths from these causes in 1884, of which 3,231 were of males and 2,339 of females.

These are classed as follows :—

Drowning	2,461
Poisoning	121
Hanging	213
Wounding	415
Wild beasts	118
Snake-bite	1,077
Others	1,165
	5,570

Of the drownings there were 308 suicides in wells and 38 in tanks. There were 906 accidents in wells and 320 in tanks. Other drownings in wells were 55 and in tanks 76. Hence, of the drownings 1,203 took place in sources of domestic water-supply. From snake-bites the mean mortality of five years was 1,185, and it is so far satisfactory to see that the deaths from this cause in 1884 has been the smallest since 1879. The months when snake-bites are most fatal are June to October inclusive, marking the time when personal care is most necessary and the destruction of snakes should be most active.

25. *Other causes.*—Deaths, of which the causes are unascertained, were 61,625, and these call for no remark.

26. *Sanitary Works* (*Military*).—The total expenditure under this head in 1884 was in round numbers 9,888*l*. Of this amount, 3,459*l*. were spent for a hospital for British troops at Ahmedabad, and 1,438*l*. at Nasirabad on the new water-supply works. The remainder was laid out on minor improvements at 19 other stations. The only remarks called for on this section of the Report are the smallness of the sum devoted to sanitary work, and the absence of any special allotments for removing well known disease causes at the more unhealthy stations.

27. *Sanitary Works* (*Civil*).—Excluding the city of Bombay, there are 164 undrained municipal towns in the province, having an aggregate population of 1,910,405. Their total income in 1884 was 308,672*l*. out of which 66,140*l*. were spent on conservancy, or about 8¼*d*. per head. In drained towns in England, in which the household sewage is removed by sewers to an outlet, the average cost of scavenging is about 1*s*. per head. In Indian towns, the conservancy arrangements include removal of house sewage by hand, or at least ought to do so. No important permanent works appear to have been undertaken in the course of the year. Most of the reports show that matters of current sanitary detail, such as surface drainage, well improvements, and surface cleanliness, were more or less attended to, but cesspools appear to be in general use in the municipal towns, and so long as this is the case none of them can be safe during epidemic times. Public latrines are coming into

more general use, and wherever there is sufficient provision of this kind, house cesspools ought to be cleansed and filled up. Dust bins have been put up in a number of these towns. In a number of instances water distribution has been extended and improved by tanks, stand pipes, &c. As will have been seen, the work of 1884 has been mainly directed to current sanitary measures, and there is no evidence in the abstracts to show that any great advances have been made. This result is also shown by the statistics from which we learn that the death-rate during 1884 in 62 towns was 29·25 per 1,000, against a previous five years' average of 29·24. All we can do on the information before us is to urge more active proceedings in the directions laid down in our "Suggestions," but especially would we advise, as one of the lessons taught by epidemics in these small towns, that no time should be lost in cleansing and abolishing every cesspool in them. Whatever method may be adopted in removing house sewage, these plague spots in houses, villages, and towns should be dealt with at once.

28. *Local Fund Circles.*—The sanitary work in these circles was mainly the providing and repair of wells, on which about 13,000*l.* were spent in the course of the year. The amount is of course very small when we compare it with the wants of many millions of the country population, but we desire to express satisfaction with this important advance in sanitary improvement so far as it has gone.

29. *Personal Proceedings* and *General Remarks.*—This, which constitutes Sect. X. of Mr. Hewlett's Report, is mainly devoted to a discussion of practical points of cholera history, during which he has brought together a large amount of experience to show that, whatever may be the cause of cholera, there is no proof that the disease is communicable from person to person. The subject is not a new one, but as there is still a tendency to revert to former views on the subject, it is necessary for the present time at least to reiterate the facts. This is the course we ourselves have adopted, for no authority of opinion as against opinion can decide such controversies, and besides it is no part of our duty to throw any influence except that derived from facts either on one side or the other.

If any carefully made observations showing that cholera is communicable can be adduced, we should of course give them all due weight, but, in place of any such, the appeal has usually been made (as in the present case, of presumed danger from a proposed cholera hospital on account of proximity) not to experience but to some one's personal opinion, on which, of course, no steps can be taken nor money spent.

30. We shall next notice certain results which have followed from the appointment by Government of a full time medical officer to inspect passengers and crews of incoming and outgoing vessels at Bombay, with the object of removing cases of sickness and treating them on shore. The officer entered on his duty on 10th August 1884, and by the end of the year he had inspected the following number of outgoing vessels:—

		Crews and Passengers.
Square rigged and steamers	163	16,309
Native craft	74	1,613
Pilgrim ships	9	7,390
	246	25,312

This experience has an important bearing on quarantine. Of the ships 114, having on board 1,732 passengers and 7,931 of crews, sailed for Europe *vid* the Suez Canal, and all were found healthy. The only diseases found on board any of the ships in this list were some cases of measles among children on board one of the pilgrim vessels which were landed, and the vessel was disinfected before sailing.

Particulars regarding incoming vessels are only given respecting those which had arrived with disease on board. Eleven such ships are enumerated as coming from foreign ports, including troopships. Their crews numbered 1,685, and their passengers 9,363. There were found on board seven cases of small-pox and 15 cases of measles, and it is worthy of remark that all these cases were found on ships which had come from Port Said and other Red Sea ports.

We have seen that the pilgrim ships cleared from Bombay after the removal of a few cases of measles, which took place among children on board one of them. But it was otherwise with the return pilgrim ships. Between the 28th October and 18th December, there arrived at Bombay ten pilgrim ships, having on board 5,303 pilgrims, from among whom there were 303 admissions to hospital, and 41 of them died. But only one pilgrim ship was placed in temporary quarantine from having five cases of small-pox on board. Of country craft, there arrived 121 from Persian ports, having 2,818 of crews and passengers on board, and 48 with 1,079 on board from other foreign ports, and none of the vessels had any infectious disease on board.

31. This experience is, of course, too limited to enable general rules to be deduced from it, but it is evident that if any danger of disease importation existed, it was incurred, not by any foreign ports, but by Bombay itself. And as we must suppose that all arrivals at Bombay left their several ports free of disease, the cases found on arrival by the Officer of Health must have become developed on the voyages, and hence the justifiable conclusion that the state of the ships is of as much importance to the results of the voyages as the state of health of the crews on departure.

32. As bearing on the same subject, it ought to be stated that in the course of the year there were 51 cases of cholera among the harbour population of Bombay, of which no fewer than 43 died. It

was this enormous mortality to which we have referred in a preceding paragraph as having in all probability been due to removal of cases from vessels to the shore and thence to a distant hospital. It may be considered certain that a cholera death-rate of 84 per cent. of the attacks is due to something else besides the disease. We would suggest whether some temporary accommodation, such as a tent near at hand, would not yield less unfavourable results.

So far as these harbour cases have a bearing on the question of quarantine against Bombay, it is in the highest degree probable that they owed their origin solely to the foul condition of the foreshores, as pointed out both by the Sanitary Commissioner and officer of health. There are port trustees who it appears have powers to prevent shore nuisances, and surely no argument ought to be required to show that by providing for the cleansing and keeping clean the foreshores, they would at the same time be invalidating one of the arguments used for enforcing quarantine against arrivals from Indian ports.

33. There is one point in which the port practice is deficient. We have seen that inspection of passengers and crews is now in use. No doubt this step is necessary, apart from any doctrinal reasons, but suppose the ship itself is a disease locality, it is clear that no amount of shore inspection of passengers will prevent the appearance of disease at sea, and quarantine might follow in spite of inspection.

The effectual substitution of ship hygiene for quarantine on arrival depends not on the health of crew and passengers at the port of departure, but on the sanitary condition and subsequent sanitary management of the ship during the voyage. The duty no doubt devolves on the captains and owners, but surely the port authorities at Bombay ought to have power to prevent careless captains from endangering the vast commerce of their city. In fact, this matter of protecting the health of ships from epidemic diseases is the only logical remedy against quarantine, and we agree with the Sanitary Commissioner that there should be power lodged somewhere to ensure that necessary measures are enforced on board ship, just as the town Commissioners are empowered to deal with unwholesome houses on shore.

This principle had the sanction of the first General Board of Health in England, and it was affirmed by the International Quarantine Conference of Paris in 1851-52. Moreover, it is in accordance with the dictates of common sense and sound reason, and it would enable clean bills of health to be more satisfactorily issued.*

34. A very important step has been taken by the Government of Bombay in the appointment of a Sanitary Engineer for the Presidency, whose services for consultation will be placed at the disposal of the local authorities. Mr. Hewlett justifies the appointment on the ground of past engineering mistakes, which he can "only term hideous." There have been many such errors detailed in past Indian reports, and they have all arisen as similar mistakes in architecture have arisen, from failing to recognize that the sanitary details of engineering and architectural works lie outside the technical details of common planning and construction. Mr. Hewlett gives an illustrative case of the Government house at Ghanesh Khind, where works of house drainage were planned and executed to remove liquid sewage, which they no doubt did, but from overlooking the sanitary element in the works, foul sewer gas was allowed to diffuse itself over the whole building. Again, there are many cases in which bathing arrangements of buildings of what may be called good architectural design have been such as to diffuse damp under inhabited rooms.

35. Another most important element in all sanitary construction is economy. Anything can be done with money at command, and most of the mistakes in sanitary as well as in architectural works have in reality cost very much more than perfectly efficient works would have done in the hands of a competent sanitary engineer or architect. Architectural effect has nothing to do with a wholesome barrack, hospital, or house. If money is no object, any amount may of course be expended in adding the architectural element. But it may be safely affirmed that the drainage works and architectural designs on which most money has been spent have not been the most healthy.

36. The sanitary rule for India as regards drainage works is that the rainfall should be removed by surface drains and a well formed surface, and that built sewers or drains for house purposes are unnecessary, for pipe drains laid down on the principles in our "Suggestions" will in the majority of cases be sufficient.

37. As regards barracks and hospitals everywhere, the plans should be based solely on the sanitary requirements for the healthy and for the sick, as these have been determined by experience, and not by theory or fancy, and, after the sanitary element has been provided for, the less money spent the better, and this rule is the more necessary in warm climates, because after a certain term of use hospitals are very apt to become unhealthy, and require to be rebuilt or evacuated for part of every year.

38. Again, a very important object to be attained by the appointment of a Presidency Sanitary Engineer is the discovery and removal of local disease causes at stations, towns, and villages, and in this part of the work he should be associated with the Sanitary Commissioner or Sanitary Officer in the manner laid down in Section V. of our "Suggestions," to which we must refer for the details. If the services of this new officer are made use of for improving the more defective stations, as well as for the municipal towns, several of which we are glad to learn have already availed themselves of his services, we have no doubt that much public good will follow.

*We have reason to believe that, since Mr. Hewlett's Report was sent in, ship inspection has been authorised, and, if so, it will turn out to be of great value to commerce.

39. Mr. Hewlett resumés the cholera discussion on the proper site for a cholera hospital in the fort of Bombay, to which we have already referred, a proposed site having been objected to on the assumed ground of the infectious nature of cholera cases. It is unnecessary for us to enter further into the question, for we have already dealt with the only important element in it, so far as the sick are concerned, and this is that hospital accommodation for cholera cases should be provided as near as possible to the points where such accommodation is required.

40. One of the most hopeful statements in the present Report is the contemplated legislation for the sanitary improvement of villages. Many years have passed since we called attention to this subject. We then pointed out that to the peculiar distribution of the Indian population, not in large cities but in scattered villages, was due both the difficulties and facilities of Indian sanitary improvements; that, while no Government could administer the staff or find the funds necessary for so vast a work, it might all be done in a week if the problem were attacked in detail, village by village, and every village by itself. Hence the absolute necessity of an efficient village organization to do the work. The measures required are neither difficult of execution nor expensive in their nature, and nevertheless, from long neglect of them, the people appear to be more liable to epidemics than they were in former times, and, as one well-known result, their death-rates are not only very high, especially from epidemics, but, as another well-known result of this susceptibility, the general stamina and working power of the people is greatly deteriorated, and their means of living reduced below the healthy standard, and this in one of the richest and naturally most productive countries in the world.

It has happened quite recently, indeed, that one perfectly mitigable or removable disease, paroxysmal fever, had so prostrated the working population that rich crops were left to rot on the ground because there were no hands to reap them. We pointed out at the time that here was the point where protecting the health of the working population was one of direct pecuniary interest to the Government, because, not only was there a primary loss of production, but this loss diminished the food of the people, and so lowered their working power and rendered them at the same time more liable to future attacks of disease. The causes of these great losses differ in different districts of India, but they are quite well known, and are all mitigable or removable.

41. So far as we know, the Government of Bombay has been the first to take up this most important subject, and, if these village organisations can be induced to do the work, it will have had the satisfaction of having solved the great Indian epidemic question, the outskirts of which have been as yet barely touched. Of course, some kind of current inspection and advising by the Sanitary Commissioner and his officers (who would be in direct communication with him, as they are elsewhere in India, on all purely sanitary questions) would be required, to secure uniformity, so that one village which was doing its duty was not injured by the neglect of its neighbours.

Precautions of this class are necessary everywhere, and there will, no doubt, be cases in which the advice of the new Sanitary Engineer will save both life and money.

42. There are a few points towards the end of the Report which may be noticed with approval, such as the projected Tansa extension of the Bombay water-supply, the sanitary improvement of manufacturing establishments, and the opening of a leper asylum, by the exertions of the Roman Catholic Bishop, which we agree with the Sanitary Commissioner as likely to be "of the greatest "service in affording proper shelter for the unfortunate lepers in Bombay." It is most satisfactory, also, to be informed that the night-soil of Bombay is now sent through the main sewer to Love Grove, so that the harbour has been at last freed from this great nuisance.

43. Mr. Hewlett concludes his report with a well-merited commendation of the work of his sanitary officers, but in the course of the year only four villages and 102 other places could be inspected.

In conclusion, the present Report contains a large amount of very useful information, but there appears to have been little to report about work actually done. There is, however, a better prospect for the future, if the villages 25,536 in number, are taken in hand.

4th March 1886.

No. 4.

Memorandum of the Army Sanitary Commission on the Report of the Sanitary Commissioner for Bengal for 1884.

1. The population adopted in calculating the statistical ratios for 1884 in this Report is that of the 1881 census, which was returned as 66,163,884, inhabiting an area of 144,863 square miles, at the rate of 456·73 persons per square mile.

2. There are 45 rural districts, containing a population of 63,705,518, occupying 227,615 villages. And 96 towns, whose conjoint population was 2,458,366 in 1881, and it is easy to see from these facts in what direction the sanitary improvement of the vast population of Bengal has to be advanced.

3. The registration of births is still confined to selected towns, 47 in number, situated in 20 districts. In these towns there were registered 39,640 births in 1884, yielding a ratio of 23·51 per 1,000 on the town population, but this rate was made up of rates varying for individual towns between 8·27 and 35·17 per 1,000. The mean rate is, of course, considerably below the truth, but the highest rate is not far from it. The birth returns, such as they are, showed 116 male births for every 100 females, but this average was made up of ratios lying between 98 and 214, so that, even in the selected towns, the birth registration, although showing signs of improvement, is not reliable.

4. Registration of deaths is carried out in all the towns and in 646 circles of registration included within the districts. The deaths from all causes in the districts numbered 1,317,167, yielding a rate of 20·58 per 1,000, against a previous five years' mean of 16·82 per 1,000. In the towns the deaths registered were 67,443 in number, showing a death-rate of 27·43 per 1,000, about 2 per 1,000 under the five years' mean, which was 29·44.

5. For the whole province the registered deaths in 1884 were 1,378,610, equal to 20·83 per 1,000, while the previous five years' mean was 17·39 per 1,000. The registered death-rates showed great diversities in different districts and towns. The extreme rates in the former were 10·59 in Durbhanga and 40·42 in Nuddea. The town rates showed even greater anomalies. The highest rate, 49·07, was reported from Gya, against a previous five years' average of 45·98, while at the other extreme we have Shambazar returning, according to the table, 1·90 per 1,000 (which ought to be 21·90), and Brahmanbarjah a rate of 2·40 (which ought to be 22·40). These, however, are merely typographical mistakes, as the data are all given. But the really lowest rate of the year was 10·63 from Dinapore, against a previous five years' mean of 10·86, showing that the registration in this town of 52,225 people requires looking after.

6. Taking the year's results as a whole, they show that considerable progress is being made with the important work of registration of deaths. The Government is quite alive to the importance of the work, and may be safely left to do the best that can be done with it.

7. Taking the year's facts as a whole, they show that in the towns registering births there were recorded the births of 21,331 males and 18,309 females, and that of the total year's deaths 749,113 were males and 629,497 females.

8. It is not necessary for us to discuss the details of registration at present. The Sanitary Commissioner has entered as fully into these as the data admit, and it is right that he should do so, because the result is that errors are constantly being exposed, which is a necessary proceeding on the way to accuracy. What we have to deal with are the general results of the year's ratios, and the relation of these to sanitary work, which we shall next proceed to discuss, beginning with the chief death causes of 1884, which were as follow:—

Death Causes.	Deaths.	Deaths per 1,000 of Population.
Cholera	134,421	2·03
Small-pox	18,533	·28
Fever	946,233	14·30
Bowel complaints	58,376	·88
Injuries	24,674	·37
All other causes	176,373	2·66
All causes	1,378,610	20·83

9. Taking these death causes in order, we find that the year 1884 was a severe epidemic year for cholera, as will be seen by comparing the annual registered deaths from this disease during the last ten years:—

Years.	Registered Cholera Deaths.
1875	109,988
1876	196,590
1877	155,305
1878	96,192
1879	136,363
1880	39,643
1881	79,180
1882	182,352
1883	90,439
1884	134,421

Epidemic cholera in Bengal is always there, and although the mortality, as the figures show, is subject to fluctuation in different years and groups of years, the tendency shown to so large an increase in 1884, it is to be feared, goes to prove that Bengal cholera, so far at least as the civil population is concerned, has not been rendered less prevalent and fatal by any sanitary measures which have been as yet carried out to cope with it.

10. We shall first deal with the year's facts as they are given in the Report, and then we propose to give some account of the very interesting year's history as this has been collected by the Sanitary Commissioner. In 1884 cholera prevailed in all the rural districts, and in 92 out of 96 towns in Bengal. Deaths from it were registered in 608 circles of registration out of 649 in the province, and, following the usual law of distribution, it attacked 24,621 villages out of 227,615, so that the year's mortality was returned by about a tenth of the population groups or thereabouts, and the rate would be about 5½ deaths per attacked village.

11. The district population, which numbered at the last census 63,705,518, registered 125,031 cholera deaths, or 1·96 per 1,000, and the town population (exclusive of Calcutta) registered 9,390 deaths, or 3·81 per 1,000 on its population of 2,458,366. The conjoint rate for the whole province was 2·03 per 1,000.

12. Every month of 1884 yielded its quota of deaths, and, although the disease appeared later in some districts than in others, the epidemic partook of the nature of a continuous stream passing over from the preceding year, a character well shown in the next abstract, which includes the monthly facts for 1883 and 1884.

Months.	Cholera Deaths.		Rainfall, 1884.
	1883.	1884.	
			Inches.
January	10,675	4,633	·05
February	4,709	3,731	·79
March	6,727	10,557	·83
April	12,691	30,785	2·63
May	13,187	20,124	6·06
June	11,389	9,884	12·04
July	8,935	7,193	11·27
August	6,994	7,179	9·33
September	2,633	3,780	8·91
October	2,289	5,530	6·08
November	3,725	15,993	·53
December	8,139	15,522	·04

As will be seen, there was a large increase of mortality in the last three months of 1884, showing that the epidemic of that year was passing onwards to 1885. The disease did not appear simultaneously in all the districts. Thus, in the four districts in Chota Nagpore there was no cholera in January, two districts only yielded deaths in February, and three in March. In Patna division two districts only out of seven suffered in January, one in February, and four in March. On the other hand, cholera was very severe in the four districts of Dacca division during the whole year. The same history was supplied by the great pilgrimage districts in Orissa division, and, with a single exception, the epidemic was fatal in all the districts of Burdwan and the Presidency division throughout the year. The districts, Cuttack, Poori, and Balasore, in Orissa division, yielded death-rates of 4·16, 3·52, and 7·79 per 1,000, the last having been the highest rate of the year.

13. But the district death-rates were only averages, and did not represent the real severity of cholera in the population groups which suffered. This is what usually happens, but a few examples may be here introduced, because of the practical sanitary questions raised by them. The cholera death-rate in Hughli district was 1·35 per 1,000, but Serampore town, in Hughli, yielded a ratio of 8·30 per 1,000, and in Uterparah circle it was 6·53 per 1,000. In this district the death-rate was very nearly the same in 1883 and 1884, although the per-centage of villages attacked in the former year was 9·43, and in the latter 13·18. The epidemic of 1884 was locally the less severe, but it

covered a third more area. With some exceptions this peculiarity presented itself more or less generally.

In Nuddea district the average rate, 5·79 per 1,000, was very high, but several of the local rates exceeded this amount, and Gangni Thana had a cholera death-rate of 17·27 per 1,000. In Nuddea no fewer than 40·72 per cent. of the villages suffered.

In Murshidabad district, 22·35 per cent. of the villages suffered and yielded a cholera-rate of 4·99 per 1,000, which rate included 10·68 per 1,000 in Goas Thana and 15·17 per 1,000 in Jelingh Thana.

The death-rate of Rajshahye district was 4·95 per 1,000, but this rate included 14·45 per 1,000 for Beauleah town, and 13·74 per 1,000 for Lalpur Thana.

These examples, selected from the Report, appear to be sufficient to show that cholera in the endemic area of Bengal presents the same characteristics as it does elsewhere in India, and the facts all appear to point to the same conclusion, that cholera may cover a large area of country without the death-rate corresponding to the area, while very high rates mostly occur within limited areas. It follows that, given the extent of country covered by any epidemic, the total mortality will depend more on the severity of the epidemic locally than on the extent of area, and hence the sanitary conclusion that diminution of cholera must be sought in dealing with the disease locally.

14. We shall next discuss the information in the Report on the general and local causes of cholera mortality in 1884, beginning with the rainfall, which we have placed in the preceding table opposite the monthly cholera deaths for 1884.

These data show clearly that, as the season advanced and the temperature rose, with little rain, cholera mortality increased, and when rain fell in quantity the deaths rapidly declined, and that when the rainy season had spent itself the death-rate began to rise, and reached a threefold amount at the end of the year, when the rain had practically ceased. As the great fall in the death-rates took place in the less healthy months of the year, and as these months followed and included the months of great increase of rain, we are warranted in concluding that the cleansing and water purifying effect of rain had entered as an important sanitary factor in the result, and hence the year's facts range themselves as evidence of the great importance of continuous cleansing and provision of pure water for local protection against cholera during epidemic seasons.

15. Although much less stress is laid in the present Report on personal intercourse as an agency in spreading cholera, there are still a few cases taken from the local reports which may be noticed.

We shall first give a case mentioned by a native medical officer, merely to point out where the evidence is defective. This officer "refers the causation of the disease to inter-river communication "of the affected villages with contiguous localities where the disease was present, and to contaminated "water-supply . . . . A woman had gone across the river Mohanunda to village Ashapore, in "Maldah, where the disease was raging, to nurse her cholera-stricken grandchild. The child died. "On her return with her clothes soiled by cholera excreta, &c. of her grandchild, her husband was "attacked, and the disease spread into the neighbouring houses, which were close to the river. It "was ascertained that soiled clothes, &c. were washed in the river, and that its water was used for "all purposes."

It will be observed that no dates are given either of the supposed importation or of the two attacks which were supposed to be related to each other. Again, the woman appears to have escaped. Next, the supposed causation is based on a theory that cholera excreta have some specific power of conveying cholera, while we now know that their supposed active germ, the bacillus, has been injected into thousands of persons under the skin in Spain without result. The cholera tainted water theory has never been proved. Besides these defects in the theory, we have the statistical facts that cholera was present in Dinagepore, where the supposed importation took place, and in Rajshahye, Rungpore, Bogra, and Pubna, forming the entire south part of Rajshahye division, for every month of 1884 except in one, and that the divisional deaths amounted to 14,084 in 2,205 attacked villages. In Dinagepore itself 146 attacked villages yielded 481 deaths. It is not necessary, in face of these statistical facts, to assume the presence of a specific germ or its importation, and the result shows that it is not safe to base our views in these matters on preconceived theories, which may land us on mere coincidences instead of proofs, while, as in the present case, they may leave us without any information as to the sanitary surroundings of the people who suffered, or of the means of improving them and saving life in future.

16. Another instance of importation, or rather other instances, are adduced by the native assistant in Noakalf district, in Chittagong division, as follows:—In certain villages in Chhagulnaia Thana, "importation of the disease was distinctly traceable in every village where the disease appeared," and here is the proof,—"Men from several villages went to collect thatching grass from the hill sides "belonging to the Maharajah, and there many of them contracted the disease and some died, and "many of them who returned apparently well were infected with the poison. The first house "in the village where cholera broke out was invariably the house to which a sick or infected man "returned, or the body of a cholera patient was carried. Generally, the largest number of deaths "from the disease occurred only in the families wherein the seed of the disease was introduced "directly from the infected hills." The disease, "when it first made its appearance, did not show "a tendency to spread widely; in a village scarcely more than two houses contracted the malady "from the one where it first showed itself. A house in each village formed a distinct centre, where "the disease was originally carried by importation. Haripur is a big village. The main road from "the subdivision to Chhagulnaia divides into two parts. The part of the village on the northern "side of the road where there was no introduction of the seed of cholera by importation remained

"perfectly free from the disease, whereas that portion of it on the southern side, where a person "returned from the infected place, suffered from the malady."

This case has been given in detail because it is one of the most fully reported importation cases, which have been hitherto adduced from India. It will be observed that no dates are given for any of the events, and no account is taken of what cholera was doing in the district at the same time, because the reporter had no means of knowing. He has pieced together a number of separate events and connected them by speculative matter so as to present a case of importation, which, in the absence of more complete explanation, was perhaps the next best thing he could have done to letting the matter alone. Besides this, the facts of locality are given, and we shall now class them all together.

17. Noakali district, where the events took place, contains 10 circles of registration, in every one of which cholera prevailed. It also contains 2,471 villages, of which 334 returned cholera deaths. There were altogether 1,374 fatal cases of the epidemic, and it covered the district during every month of the year. It will be observed from the history already given that the men first attacked were at work in the open country where the facts show that the epidemic prevailed. They returned to their villages, and what the state of these villages was is faithfully described, and, in fact, this constitutes the true key both to the cholera predisposition and to the required means of prevention. "The above localities are in a very unsanitary condition. The water-supply is bad, several of the "deep tanks being in a foul state from ingrowth of rotten vegetation. Putrid cowdung is heaped "up near dwelling-houses. The dead are buried on the banks of the drinking water tanks." And by way of contrast it is stated that, "Naokali jail, with its superior sanitary arrangements, enjoyed "perfect immunity, although surrounded by the disease."

In this same district there was a severe outbreak in Sudharam town, yielding a death-rate of 4·29 per 1,000. It was confined to Hindus in localities "where the houses were damp and their "surroundings filthy, and the neighbouring drains were offensive and contained in many places "stagnant and foul water."

18. The next case is one of more importance, as it relates to the importation and spread of cholera by pilgrims from Poori, and is thus stated by the Civil Medical Officer, "There is a sameness so "recurring that whatever the theories may be of its causation, whether induced by the impurity "of drinking water, solar or atmospheric conditions, &c., there is little room for doubt as to its "communicability and dissemination by human agency, also that it impresses most where persons "congregate most, and this the large halting grounds in this district bring out pretty clearly, cholera "making its march on and its retreat from these with great distinctness; Khorda Pipli (Satyabadi) "and Poori town, as the centres on which the pilgrim streams converge, suffering the most." The unproved part of this view is that cholera is communicable from person to person. The other parts of it are matters of experience. The distinction is of importance, because on maintaining it depends our adopting rational methods of dealing with the disease. But, as the question has been again raised in the present Report, we may point out that some time ago we gave, in one of our Memoranda, an account of an analysis of causes of death on pilgrim routes, which showed that only a small minority of the deaths, in that instance at least, arose from cholera. We adduced the case to show the need of careful inquiry, so that the exact relation of pilgrimages, not to general mortality, but to mortality from cholera, should be ascertained. The same inquiry showed that the deaths at Poori were by no means all due to cholera. But it may be safely held that crowding along pilgrim routes and at shrines with their sanitary defects, even if no such a disease as epidemic cholera existed, would be attended by a large mortality, and still more is this likely to be the case with a virulent epidemic disease. So far as we know, the real elements of danger are the present deplorable local insanitary conditions, the unhealthy state of pilgrims crowding in successive batches along the routes, excitement, defective or bad food and bad water. Wherever these conditions are found in pilgrim bands or in villages into which they crowd there increase of cholera may be expected. But cholera must also be present in the country, as it was during every month in 1884 over the whole of Orissa, where 17,983 people died of it. The disease was returned from all the registration circles, but it was present in no more than 4,236 villages out of 20,306, a large per-centage no doubt, but nevertheless, in this chief pilgrim region, where bodies of pilgrims moving to and from the shrines must have passed through many villages, the proportion of villages attacked fell far short of that in Nudden, far away from Orissa, where nearly half of all the villages suffered. The evidence of fact, apart from hypothesis, may be accepted as proving that, under existing conditions, crowding of foul localities by pilgrim bodies may increase cholera mortality, but there is no proof that this cholera is all due to, or indeed that any part of it is due to, any form of cholera germ or specific cause. The Sanitary Commissioner, after carefully examining the whole history, concludes as follows:—"I am "not prepared to uphold the view that cholera is dispersed throughout Orissa entirely by foreign "pilgrims and inhabitants of the districts who largely frequent the different temples at times of "festivals, yet there is shown above such correspondence of disease with periods of festivals that this "view cannot easily be set aside, and it must be remembered that this tends to explain the great rise "of the disease in June and July, a time of comparative immunity from cholera in Bengal."

The practical conclusion from the whole discussion on the public health side is hence, that if the evil influence of the pilgrim element, with its fatigue, filth, crowding, and starvation, could be put a stop to there would be less cholera, but if it is to continue the only safety from its effects must be sought in thorough improvement of the sanitary state of the villages and routes.

19. In other districts of Bengal there was little cholera at fairs in cases where ordinary sanitary precautions were taken. The exact statistics of these fairs are not given in the Report, but we may

quote from it the following general statement:—"Of the very large number of fairs held in the "districts, outbreaks of cholera occurred only in the following." Four affected fairs only are mentioned, and we may give the facts for the sake of comparison with the Orissa pilgrim cases. "In "city *Murshidabád*, during the Moharrum, when about 10,000 people were assembled, cholera broke "out and caused about 100 deaths. All sanitary precautions appear to have been taken. The "magistrate believes that this outbreak is referable to the effect of dissipation and bad food." We can connect this outbreak with the prevailing epidemic as follows. Cholera was present in Murshidabad district during every month of 1884 except September, and 6,128 people died of it, showing a death-rate of 4·99 per 1,000, against a previous five years' mean of 1·48 per 1,000. In the city the cholera death-rate was 5·42 per 1,000, showing that both in city and district the disease prevailed in considerable intensity. No wonder if "dissipation and bad food," with the other concomitants, gave rise to an outbreak.

At *Mongalbund* fair, in Dacca, 95,000 people were present, among whom there were two cases of cholera and eight of choleraic diarrhœa. There was no death, and the people dispersed at once. No sanitary details are given. Cholera was present every month in Dacca district, and yielded a death-rate of 3·85 per 1,000, against a previous five years' rate of 1·62 per 1,000.

In the same district another fair, held at *Munshigunge*, yielded four deaths from cholera out of five cases. This fair lasted six weeks, and was attended by 3,282 persons daily, or 144,443 in all. There were 12,177 boats on the river. "The sanitary precautions adopted were all that could be desired."

"At a mela held in *Cuttack* six persons died of cholera; no special sanitary precautions had been taken." Cuttack is one of the Orissa pilgrim districts, and yielded a death-rate from cholera of 4·16 per 1,000, against a previous five years' mean of 2·53 per 1,000.

20. The experience of these fairs may be thus summed up. Of the "very large number of fairs" held in Bengal, all escaped cholera except four. At one of these there were no fatal cases. At the other three there were 110 deaths, but 100 of these took place, as stated, at Murshidabad, not at a fair properly so called, and in the districts where these assemblies were held, cholera reigned with a nearly twofold mortality. The result of this year's experience is that, with ordinary sanitary care, there is little risk of cholera at fairs.

21. The local causes of epidemic outbreaks in Bengal are so well known that it is scarcely necessary to refer to them. But as we have already cited one or two local cases, we may add the following. Referring to alleged importation of cholera into unhealthy localities by pilgrims, the Sanitary Commissioner makes the following remarks as the result of inquiries:—"The fact is that, when cholera, "engendered by causes not yet definitely determined, and fostered by climatic influences or local "insanitary conditions, is prevailing in any locality, pilgrims, if present there, suffer in common with "the local residents, often more severely, owing to fatigue, old age, debility, bad food or water, &c., "but they do not impart or communicate the disease." And he gives examples of from fivefold to tenfold mortality in villages not traversed by pilgrims over the death-rates in villages through which they had passed.

22. In *Midnapore* town, the cholera death-rate of which was 5·89 per 1,000, people who were "indifferent regarding their water-supply, which was bad, and whose surroundings were most "objectionable in a sanitary point of view, suffered most, while those who were most particular in "these matters escaped."

23. A very fatal outbreak took place in bustees of coolies at the jute mills of *Rishra* and *Mohesh*, in Hughli, "which are attacked annually." There were 214 attacks among them, and 118 died. "The bustees are densely crowded, are in an insanitary condition, and the habits of the people "residing in them are filthy."

It is an important fact in cholera history that these coolies mixed freely with the rest of the population without communicating the disease. An obvious suggestion on the facts as reported is that some one should be held responsible for this useless destruction of human life, the causes of which are purely local and remediable. Fire and sulphur were used as disinfectants, but if it may be suggested that the real cause was not in the air but in the bustees, it would appear to follow that, in default of other remedy, the most effectual would be burning the bustees and providing better accommodation for the work people.

24. In *Howrah* town, which had a cholera mortality of 7·78 per 1,000, bad water was an assigned cause.

25. The *Suburbs of Calcutta* yielded a death-rate from cholera of no less than 9·62 per 1,000, and in regard to certain areas of them the following notes are introduced:—

"*Manicktolla* is the most filthy part of the suburbs, the land behind the houses being used as "public latrines. In fact, all the bustees in this area are in an extremely insanitary condition" from the filth and refuse lying about, and the "ponds, hollows, and low lands being the receptacles of "liquid sewage and filth."

Garden Reach and its bustees are in a similar condition, as are also about a dozen other areas. In some cases the state of things scarcely admits of description, and yet the suburbs are in reality part of the capital of India, and some sanitary work has been professedly done for the suburbs during the past 20 years. The only effectual remedy for so deplorable a state of matters is to include the suburbs within the municipal boundary of Calcutta, and to provide an efficient and active sanitary administration for the entire area.

26. *Nuddea* had a cholera death-rate of 5·79 per 1,000, rising in Gangni town to 17·27 per 1,000. "On the whole its severity, this year, is attributed to bad water-supply, which was general throughout the district owing to scanty rainfall causing the tanks and water reservoirs to run very low, to defective drainage, to the filthiness of the villages, and to want of wholesome food." The excessive death-rate of Gangni is attributed to the water having been taken "from the pools in the khals, into which only local drainage enters, and in which bathing both of men and animals is carried on." Other examples of most deplorable sanitary neglects and their results are cited from the Nuddea report.

27. In one of the old cholera centres, Jessore, there was a 4 per 1,000 cholera death-rate. This place has suffered from cholera since 1817, but the lesson supplied annually by the epidemic appears to have produced little result, for the town still has the following death causes to contend with:—"Its unhealthiness is in some measure due to the insanitary conditions obtaining in it, for the general conservancy is not properly attended to; the privies are filthy, the attendance of the mehters being irregular, the night-soil is not properly trenched, the drainage is defective, as most of the drains are mere open ditches, and some of the bazaar drains are obstructed by refuse from the shops, the culverts being used as receptacles for rubbish. Very nearly all the tanks contain organic matter, being open to every description of pollution, and the graves are not dug sufficiently deep."

28. The case of *Dacca* town is again referred to in the present Report in connexion with its improved water supply, which was supposed, on the cholera water theory, to afford protection against the disease. Nobody doubts the benefit of good water to the health of a community, but a fundamental position in sanitary work is, that no amount of the purest water by itself will protect a people from diseases due to causes not connected with water. In Dacca town the cholera death-rate in 1883 was ·59 per 1,000. But in 1884, in spite of the good water, the rate rose to 2·88 per 1,000, due to the following assigned causes:—"The drainage is very defective. There is an absence of all natural drainage. The levels of the streets and lanes are very irregular, and the courtyards of houses are, as a rule, a foot or more below the level of the roads and lanes, precluding house drainage connexion with the main drains. The night-soil and scavenging establishments are below the requirements of so large, so dirty, and so irregularly built a town as Dacca. It has not yet been provided with a sufficient number of public latrines, and worse than all many gors, well privies, and contaminated wells yet exist." All these defects are well known local causes of cholera, apart from the state of the water-supply, and they will continue to levy their death tribute year after year until suitable remedies are applied. No doubt much bad foul well water is still used, and this appears to be one of the present results of the new municipal *régime*, for the Sanitary Commissioner tells us that, "it is found hard to get the native members of the municipality to believe that well-water in Dacca is only diluted sewage." It is clear that what Dacca requires is thorough sanitary improvement, the filling up of bad wells and foul cesspits, cleanliness, and good drainage. It is also clear that, with the present relative levels of houses, house compounds, and streets, no house drainage is possible, and that the only alternative is collecting all sewage and removing it by hand labour.

29. The case of Dacca has been here referred to on account of the contradiction it gives to the one cause theory of cholera, and we may here contrast with it the statement of the subdivisional officer concerning a severe outbreak in some villages in the Dinapore subdivision. He says, "The most remarkable point in regard to the outbreak is that the disease broke out in places where cleanliness was very rigidly observed, while on the other hand villages, which were, so far as outward appearance went, in a filthy state, escaped the epidemic altogether."

It follows from this Report that, as is well known, the mere surface conditions of a town or village are no test of its liability to cholera. But it also shows that something other than local conditions must be present before cholera can break out, and this is the epidemic itself. The surface clean villages which were attacked had their own localizing conditions, but generally these are under the surface, and are to be sought in foul compounds, dungheaps, cesspools, and foul wells as the result of foul subsoils. Why the apparently filthy surfaced villages escaped we know not, but it is highly probable that their turn will come in due time.

30. *Faridpur* town had a cholera death-rate of 6·13 per 1,000, and the following facts about the disease are stated by the Civil Surgeon:—"Those cases which occurred in the town were in the persons of those who had nothing to do with any previous case of cholera." None of the attendants on the sick, averaging eight per case, suffered from cholera. Cases presented themselves among persons using all kinds of water. The disease was most severe in low damp places hedged in by trees, and ill ventilated and dirty. Neighbouring villages obtained their supplies from the cholera-stricken town bazaar without being attacked by cholera. "The jail situated in Ward No. 3, having an average population of nearly 200 persons, remained altogether free from the disease, though cases occurred within a few hundred yards from the garden, and prisoners were admitted into the jail from infected thanas of the district."

These facts belong to a class showing apparently the simple non-transmissibility of cholera from person to person.

31. *Port of Calcutta.*—Cholera among the river population was more severe in 1884 than during the previous year. The average population of European seamen was 1,684, among whom there were 67 cholera cases and 36 deaths, equal to 21·37 per 1,000. The native floating population, averaging 25,409, yielded 138 cholera deaths, or 5·43 per 1,000. No account is given in the present Report of the local causes.

32. It will have been observed that nothing new in the history of cholera has been revealed by the experience of 1884. It is the old history repeated year after year of great numbers of population

groups scattered over the surface of Bengal living under very bad sanitary conditions and a cholera epidemic, whence coming no one knows, but swooping down in a most irregular manner on certain of these groups, and leaving others of them until a future season, and the practical conclusion is simply that had these attacked groups been in a healthy condition they would almost, if not altogether, have escaped the epidemic of 1884.

33. *Small-pox.*—The registered mortality from small-pox for five years preceding 1883 was ·29 per 1,000; the rate for 1883 was ·14 per 1,000; and that for 1884 was ·28 per 1,000. In 1883 there were 9,714 small-pox deaths, and in 1884 the number registered was 18,533, or double the preceding year's mortality. The disease existed in all the 45 registration districts, with two exceptions, Darjiling and Jalpaiguri, and in 424 registration circles out of 649; but the mortality was returned from no more than 6,749 villages out of 227,615. Hence it follows that small-pox covered nearly the whole area of Bengal, but the death-rates were purely local. The attacks were endemic, but the area was epidemic. This is the usual history of Indian epidemic diseases. Severe as was the outbreak of 1884 in Bengal, it was a comparatively small matter when compared with the great small-pox epidemic of the North-West Provinces and Oudh for the same year, during which upwards of 200,000 people perished.

34. In Bengal every month of 1884 yielded small-pox deaths, and, as will be seen from the following abstract, there appears to have been an entire epidemic in the course of the year.

Months.	Small-pox Deaths.	Months.	Small-pox Deaths.
January	826	July	1,312
February	1,411	August	717
March	2,637	September	336
April	3,715	October	354
May	3,705	November	392
June	2,543	December	585

Out of 96 towns 34 registered 2,711 deaths, or a death-rate of 1·10 per 1,000 on the total town population, while in the rural districts there were 15,822 deaths, or ·24 per 1,000. As bearing on the present state of vaccination, it is important to point out that of the total year's mortality from small-pox, which amounted to 18,533 deaths, there were 4,193 deaths at ages under one year, and 13,395 under 12 years of age. The highest rates were returned from four districts in the Patna division. The highest small-pox rates in the towns were 6·91 per 1,000 in Gya, 8·23 in Hazaribagh, and 9·05 per 1,000 in Bhagulpore. Dinagepore town had only one small-pox death among 12,560 people, an exemption which the magistrate accounts for by stating "that as the Dinagepore town is "yearly almost wholly burnt down and thoroughly cleansed by fire, he thinks that for this reason "perhaps small-pox gets no hold on the place." It would appear as if there was truth in this view, inasmuch as the death-rate from all causes in 1884 was only 13·61 per 1,000, and its previous five years' average 22·83.

35. *Vaccination.*—There is full information of a departmental kind on the vaccination work for the official year 1884–85, but we shall confine our remarks to the working results.

The establishment was as follows:—

Superintendents		8
Deputy Superintendents		12
Inspectors and Native Superintendents		85
Head Vaccinators		23
Vaccinators, circles	276	
" municipal dispensaries	213	
		489
Apprentices		56
Licensed Vaccinators, circles	1,067	
" " municipal	27	
		1,094
Total staff		1,767

Leaving aside unsuccessful operations, those returned as successful were,—

Primary vaccinations	1,457,105
Secondary vaccinations	5,489

These numbers represent 99·38 per cent. for the primary, and 48·22 per cent. for the secondary, operations. The Vaccine Department does not apparently cover the entire population of the province, which is 66,163,884, for the returns apply to a population of 50,571,655.

36. In estimating the value of the protection afforded we ought, however, to adopt the larger rather than the smaller population. But we have no means of comparing the vaccination operations with the births, for the rate of 23·51 per 1,000 for 47 towns is evidently below the truth. We may, however, safely estimate the annual birth-rate at 30 per 1,000, and on the total population of the province there would on this estimate be 1,984,916 births, while for the smaller population within the

vaccination area the births would be 1,517,150 approximately. Either number would roughly represent the available subjects for infantile vaccination within their respective areas. But, as we have seen, the primary successful operations in 1884–85 were 1,452,105, and when these are arranged according to age, they give 211,386 vaccinations under one year, and 977,894 between one year and six years, so that only about a seventh part of the births is represented by the operations under one year of age. The practical result hence appears to be that although the total vaccinations do not fall very much short of the births within the vaccinated area, they are so distributed among the ages as to afford little protection to the infant population. This defect points to the necessity of an improved direction of the work towards the ages under one year.

37. *Fevers.*—The most unsatisfactory portion of the year's sanitary history in Bengal is the great loss of life from "fevers," which, as the statistics show, cut off 966,233 people in 1884. As yet we know very little of the nature of these fevers, and as on a correct knowledge of them depends much of the possibility of dealing with their causes, it seems not out of place for us strongly to advise that there should be inquiry and report on the subject. But whatever errors in diagnosis there may be in the returns, these have prevailed in other years, and the loss of life from this class of diseases in 1884 is the greatest on record, while it shows a great loss of working power among survivors. The deaths since 1871 have been as follows :—

Years.	Fever Deaths	Deaths per 1,000.	Years.	Fever Deaths.	Deaths per 1,000.
1871	169,505	2·56	1878	743,887	11·23
1872	237,868	3·59	1879	632,260	9·41
1873	308,645	4·59	1880	689,605	10·43
1874	323,721	4·27	1881	946,911	14·23
1875	368,087	5·56	1882	929,943	14·06
1876	561,582	8·49	1883	915,766	13·81
1877	711,086	10·75	1884	966,233	14·60

The only satisfactory part of this abstract is that it shows improved registration of deaths; but if the local fever causes had not increased the liability to fever attacks among the population, there is no apparent reason why the fever death-rate of the scarcity years, 1877–78, should not have undergone continuous reduction when the emergency has passed away, instead of shewing the large augmentation of subsequent years.

38. Fever mortality covered the whole province in 1884, for deaths from it were returned from every one of the 649 registration circles, and out of 227,615 villages 147,466 returned deaths. It is probable that few, if any, of the villages escaped attacks.

Deaths among males averaged 15·94 per 1,000 of the total population, and the deaths among females were in the ratio 13·28 per 1,000. The provincial death-rate was 14·60 per 1,000, and the preceding five years' mean was 12·38 per 1,000. The highest rate of the year, 30·40, was returned from Rajshahye, where 40,698 people died of fever. Nudden, the chief fever district, lost 48,383 of its inhabitants, or a death-rate of 29·22 per 1,000. The previous five years' rate of this district, which includes a great fever epidemic, was 31·72 per 1,000, showing a reduction of 2½ per 1,000, but the high rate in Rajshahye shows a real epidemic increase of 6·37 per 1,000. Not one of the 26 towns escaped. The deaths among them numbered 31,701, or 12·89 per 1,000. In a number of them the rates were as high as between 2 and 3 per cent.

39. The following abstract gives the monthly deaths in 1884 contrasted with the monthly rainfall for the same year, and the mean monthly mortality for the previous 12 years, 1879 to 1883 :—

Months.	Fever Deaths, 1884.	Rain 1884. In.	Fever Deaths, 1879–88.
January	35,385	·05	73,828
February	69,933	·79	57,918
March	78,762	·36	58,362
April	76,711	2·63	59,548
May	71,070	6·06	55,053
June	68,523	12·04	49,359
July	65,958	11·27	55,662
August	77,188	9·38	62,756
September	75,375	8·97	66,555
October	88,424	5·08	80,794
November	113,836	·58	99,899
December	104,582	·04	100,123

This table shows that the months of highest fever mortality in Bengal are October, November, December, and January, during which there fell only 5·7 inches of rain in 1884. The fever in these months was not the result of absolute quantity of rain. There was cessation of rain, drying up with its disengagement of malaria, together with low and variable temperatures. These atmospheric conditions may be assumed generally as those usually present during the months of maximum fever mortality. But the high cumulative rainfall of the preceding months must also be borne in mind, and the effect of this on the subsoil before the drying up began must be considered.

40. The following facts connected with local fever prevalence are of importance. The former great fever area of Burdwan had a fever death-rate of 18·81 per 1,000, against a previous 12 years' rate of 23·77 per 1,000. There has been drainage work carried out in this district, but, besides this, the rainfall in 1884 was under the average.

41. In the parts of Bankura which suffered most from fever there is marshy undrained land covered with jungle. But the laterite tracts, "where the soil is porous, and the natural drainage "very good, enjoyed comparative immunity from the disease, and here it is uncommon to find cases "of advanced malarial cachexia."

42. There is an account of fever and its local relations in *Midnapore* by Dr. Ghose, Officiating Sanitary Commissioner, of so much interest and importance to the whole question of fever etiology that we shall quote it. Referring to 13 villages, he says:—"All these villages, with the exception "of Churs Najooreh and Bilkota, are within the protective embankment along the right bank of the "Roopnaryan river. The drainage from them is perfect, *i.e.*, all tide and flood water is excluded "by means of embankment and sluice gates, and surface channels drain out the last dregs of rain-"water through these sluices when no longer required for paddy cultivation. The result is that no "vestige of malarious cachexy is to be seen in the people. But the people of Churs Najooreh and "Bilkota, living on churs generally inundated during the rains, have well marked signs of malarious "disease in them. Those who wish to study the effect of drainage on malarial fevers and on "agriculture ought to come here and see the condition of the people within the embankment. In "the two villages on the churs outside the embankment the paddy crop is uncertain, liable to the "rotting effect of inundation and the parching effect of drought. The pulses, as a rule, are affected "by worms, the oil-seeds grow but indifferently. The only paying crop is water melons, which do "well in dry weather on all *chur land*, whereas within the embankment, where no such thing as a "bhil could be seen, the paddy was perfect, and I saw in many places, after the paddy had been "cut down, the pulses and oilseeds had been sown broad cast and doing very well. Those who "declare that well drained land is unfit for paddy cultivation ought to visit these places. What "struck me most in all these villages was the entire absence of low jungle, a state of things I have "not seen in the deltaic portions of Bengal. I also observed that the people do not dig ditches in "village sites for taking earth for their plinths or walls, but uniformly take nine inches from the "surface of their fields, which is soon replaced by silt washed down by rain." Their water sources are bad, but the tanks are kept clean. Dr. Ghose further says that in certain thanas, Keshpur and Midnapur, the villages are below the high-level irrigation canal level, and malarious. Carefully observed facts of this kind are precisely what we want to enable us to understand the causes of these fevers. Here we have a distinct case in which properly arranged surface drainage is detrimental to the growth of jungle, and is favourable to the growth of paddy crops, usually supposed to require flooded ground, with its consequent subsoil stagnation, and where the people are saved from the ravages of fever, the whole being done by simply opening and closing flood sluices at the proper time.

43. We shall now take a case of a very different kind, which shows the great danger of adopting the fallacy that a sanitary work of drainage once accomplished may be left to itself.

Some years ago the water of the Damoodar was brought into the channels of the Kana Nuddi and Sarasiti to produce a flow, to improve the drainage, and to bring water to the villages. The work was accomplished at a large outlay, and now the Subdivisional Officer of Serampore tells us that the work "is now going to ruin for want of little attention and a trifling amount of expense." When first done it was attended by immediate improvement in the health of the people, and in 1884 the people along the partially silted up channels are said to have "suffered very much," and he says, "I must express my total inability to understand a policy which spends lacs of rupees on important "sanitary work, and then leaves that work to go to ruin in a few years in order to save an annual "expenditure of a few hundred rupees."

The real reason appears to be that the authority which took charge of the work had no adequate knowledge of its sanitary relations, otherwise we must adopt the conclusion that "the few hundred rupees" a year were considered to be a fatal objection to keeping the channels open. Any way the case needs being looked into and the people's health protected.

44. In the 24-Pergunnahs there was less fever generally than in 1883, but nevertheless some villages suffered from excessive fever-rates. In several villages in Bussirhat thana many of the children were found to be pale, scrofulous, and suffering from spleen. "The sanitary condition of "these villages is very unsatisfactory, the drainage bad, and the water-supply worse." Much of the malarial disease in these places is due to obstruction of outlet drains and general stagnation of subsoil water. The observation is made anew by the Deputy Sanitary Commissioner, that where there is much water there is less fever, and that a feverish locality is a moist rather than an absolutely wet one.

45. A case is mentioned where closing a river channel by vegetation and other matters had spread fever over the neighbouring villages, in consequence of which Dr. Ghose advised that surveys should be made for remedying this fever cause. The reply of the magistrate was that "it is useless to ask "engineers for plans of works which will never be carried out, and would be of doubtful utility if "carried out." On this decision the Sanitary Commissioner very properly remarks "that the "question as to the manner in which drainage is to be effected in places where the old drainage "channels no longer exercise their original functions is a most important sanitary one, and should "be considered in the Public Works Department as funds and opportunity permit." Of course it

should. Work of this class is a part of the ordinary sanitary survey work which ought to be part of any administrative arrangements dealing with these delta lands. The results of neglect of these conditions are stated by the Sanitary Commissioner that, on visiting the village schools, he found the health of the children very bad. "There was evidence of the effects of malarious poisoning in "nearly everybody I saw." There were many deserted homesteads, and the population had diminished.

46. Nuddea district was the seat of a severe fever epidemic a few years ago. Improvements were projected, but we know not to what extent they were carried out. Any way, the fever mortality, which on a five years' average had been 31·72 per 1,000, was 29·22 per 1,000 in the year under review.

47. It would occupy too much space to abstract all the information which this Report contains on the local etiology of fever. The details we have given will show its general nature, and it will be observed that great stress is laid on obstructed drainage as a fever cause. Suppose a new country similar to the Gangetic delta with all its watercourses and affluents free, so that drainage was sufficient and without obstruction. Such a country would in all probability be free of fever when first settled. But this most recent Bengal experience teached us that if from any neglect on the part of the inhabitants the drainage channels became obstructed so as to back water the subsoil there will be fever.

Real preventive sanitary work having been neglected, deterioration of sanitary condition and the advent of fever and other epidemics is simply a matter of course, and no future sanitary proceedings can ever restore a locality where epidemics have once shown themselves to its original condition. All that subsequent sanitary engineering can do is to remove drainage obstructions and keep them away for the future, and this can only be done by examination, by present work, and by future engineering supervision. The work is strictly a sanitary one, and must be so regarded if any good is to be done; this appears to be the teaching of the present Report, and it may be taken safely as ground of action. There is less said than in former Reports on the state of the villages; this remains, no doubt, much the same as it was. If the villages are improved as they ought to be the fatality of fever will become less year after year, but the amount of fever is connected with the subsoil water, which in its turn is dependent on the drainage outlets, and it will continue pretty much as it is until they too are made efficient.

48. *Fever in the Port of Calcutta.*—Among European seamen in port there were 297 admissions from "simple fever," 158 from malarious fever, of which two proved fatal, and there were seven cases and five deaths from enteric fever. There were only four fever deaths in 1883. The port floating population yielded five deaths from malarious fever, and ten from simple fever. There was nothing worthy of remark in the facts, except the much lower mortality than prevailed among the country population.

49. *Bowel Complaints.*—Under this head were registered 58,376 deaths, or ·88 per 1,000 of the population, against ·82 per 1,000 in 1883, and ·81 for the preceding five years' mean. Deaths from this cause were returned in 1884 from 627 registration circles out of 649, and from 24,150 villages out of 227,615.

The seasonal mortality was as follows:—

Months.	Bowel Complaint Deaths.	Months.	Bowel Complaint Deaths.
January	4,865	July	4,525
February	3,932	August	5,089
March	4,634	September	4,590
April	5,000	October	4,348
May	5,050	November	5,706
June	4,842	December	5,788

The death-rate was ·79 per 1,000 for the districts, and 3·24 for the towns, or fourfold. The Sanitary Commissioner calls attention to the fact that "the mortality in hot, rainy, and cold months "follows no rule, indicating very defective registration."

Among European seamen in port there were 125 cases of diarrhœa and 80 of dysentery. Three of the former and two of the latter proved fatal.

50. *Deaths from injury* numbered 24,674, of which 2,612 were from suicides, 1,591 from wounds, 10,078 from accidents, and 10,393 from snake-bites and wild beasts.

51. *All other causes* accounted for 176,373 deaths. In concluding this abstract of the disease history of 1884, it may be noted that European seamen yielded 15 cases and three deaths from sunstroke and heat apoplexy. Among the greatly more numerous floating Native population there was only one case not fatal. It is worthy of remark also that there were 24 seamen treated for scurvy, of which disease one died, and that 17 cases were in six New York vessels; there was lime-juice on board, but the officers did not appear to know the quantity which should have been issued.

52. *Sanitary works, Civil.*—The income of 175 municipalities in Bengal for the year 1884 was Rs. 32,78,326, of which 38 per cent. was appropriated for sanitary purposes. This money was laid out on the following objects:—

	Rs.
Conservancy and latrines	3,99,293
Conservancy establishment	2,82,206
Drainage	1,05,973
Water-supply	1,35,181
Disposal of dead	8,341
Markets and slaughter-houses	24,042
Vaccination	12,481
Treatment of sick	1,87,185
Other sanitary works	78,087
Total sanitary	12,32,789
Roads, &c.	6,28,578
Total outlay	18,61,367

Deducting Rs. 1,99,666 spent on vaccination and treatment of sick, the amount spent on sanitary works and measures properly so called would thus have been Rs. 10,33,123, or in round numbers 103,000*l.* Compared with the preceding year's outlay there was an increase of Rs. 91,342 on conservancy and latrines, but there was a decrease of Rs. 43,654 in the establishment charges, so that probably the service was less efficient notwithstanding the larger outlay.

53. Details of local sanitary measures are given in the Appendix, and include a large number of items under different heads of expenditure already stated. No doubt good work, though on a small scale proportionately to the requirements, had been done in the course of the year; many wells were sunk anew or improved, tanks were put in better condition, and many were excavated. Local advances in drainage were also made, and the following statement about drainage improvements in Nuddea is of importance:—"Further improvements to the drainage of the fever-stricken district of "Nuddea were effected, the work consisting of the construction of a good many arched culverts and "wrought-iron girder bridges on masonry abutments, of the completion of the works on the road "from Chagda railway station to Bougong, and of the construction of four arched culverts on the "Chapra and Nishhindpur road. These culverts span drainage channels." Many drainage schemes have been prepared, and some have been sanctioned, but are delayed from want of funds. These works, which are intended to restore water-ways, will no doubt be of benefit to the health of districts when they are carried out.

54. There is one point in the drainage of Murshidabad which requires notice. "Owing to want "of proper flushing the two main channels within the Shamnagar and Mohimapur wards did not "work well through the pipes, which are only six inches in diameter. The pipes are already a good "deal choked up with silt, and there are no means of cleansing them unless they be taken up and "relaid, a work requiring much attention and enormous cost." This result involves a defective application of the following principles of Indian sanitary engineering work:—

(1.) Rainfall should always be conveyed to an outfall by open shallow impervious surface channels. Unless under special conditions built sewers or pipes are not necessary for such purposes.
(2.) Pipe-sewers should be only applicable to house drainage purposes.
(3.) No pipe-sewers should be used unless there is sufficiency of house water available to keep them clean, or of water for sewer flushing.
(4.) When house drains cannot be had in combination with sufficient water it is better to trust to hand removal of house sewage.
(5.) Where surface drains are used for removing foul water it is necessary to provide sufficient water to flush and keep them free of offensive deposit.
(6.) It is by no means an adequate solution of the drainage question to execute drainage works and then to leave them to themselves. Sanitary works require careful oversight after they have been completed. As regards the obstructed sewers, the usual way of dealing with such cases is to pass rods along the pipes to loosen the deposit, and to wash it out with water. But, with proper care, the silt might have been kept out of the drain pipes.

55. In Patna municipality, in defect of funds for a larger scheme, provision has been made for keeping the rainfall from stagnating by a system of pucca surface drains. "The works have, it is said, already proved of the greatest service."

56. A somewhat similar work was projected at *Chittagong*, where drainage is very much required. "Surveys, reports, estimates, &c. were submitted by the Public Works Department, but, as usual "with these things, the labour expended in making the plans, &c. has all been wasted in some "pigeon-hole at head-quarters."

57. Plans and estimates had been prepared for draining the Rajmehal swamp, but the local proprietors would not contribute to the cost, which the Deputy Commissioner regrets, because of

"the extreme unhealthiness which has led to the almost depopulation of the tract once teeming "with a wealthy Mussulman population." This swamp is on part of an old bed of the Ganges It is much to be regretted that this work is stayed by the people whose interests it would benefit.

58. As we have already seen, about 10,500*l.* were expended in the course of 1884 by municipalities on drainage. The amount is so small, in comparison with the necessities, that we may recur to a proposal we have often made to try to obtain relief from the dangerous effects of rain stagnation by filling up excavations, improving the surface, and cutting surface channels to allow the water to escape. This could all be done by the people, or any way at a very small outlay.

59. *Water-supply.*—The most important item under this head has been the completion of Burdwan waterworks, which were opened by His Honour the Lieutenant-Governor on the 4th November 1884. "The measure has proved, it is said, to be of great benefit to the inhabitants of the northern "portion of the town, in which pipes have been laid and hydrants set up." At first many of the inhabitants were unwilling to use the filtered water, but now about 99 per cent. of them do so, and opposition has died away. There are 60 hydrants, but more have been applied for, and the supply of water is ample. House connexions have also been sanctioned. In this, as in other similar cases, we must repeat a caution we have often given, and this is, that whether the new water-supply, especially after completing the house connexions, is to be a benefit or an injury to health depends on the drainage provisions made for keeping the water after use out of the subsoil. Water-supply and drainage are not two separate works. They are one combined work.

60. The waterworks of Dacca have been further improved, and we are glad to see that "the "munificent Nawab Assanoolah has, in commemoration of the visit to India of their Royal Highnesses "the Duke and Duchess of Connaught, extended the waterworks northward up to Nawabpore "Road." This is stated to be of great benefit to a poor and crowded neighbourhood. India at present affords abundance of opportunities for men of wealth and influence to bestow similar benefits on their poorer fellow-subjects. The example is one which should be commended and followed.

61. "In the Bhagulpore town a scheme of water-supply has been sanctioned by Government, and "material and plant are being collected for carrying it out." We are glad to learn that in this instance Government has placed the aid of the Superintending Engineer and his subordinates at the service of the town free of cost.

62. Improvement of the water-supply in Nuddea district is under inquiry, one object of which is to ascertain, if possible, to what extent the great prevalence of epidemic diseases there is due to bad water. A curious fact is stated about well water, and this is that the people rarely use it because it gives them nasal catarrh.

63. The Commissioners of Howrah were arranging for a water-supply, in the benefits and costs of which they proposed that other riparian municipalities should join. An assembly of delegates of these municipalities was summoned, and it appeared probable that they would join in the work. In this case the services of the Executive Engineer were lent by Government.

64. These instances have been selected to show the chief objects on which money has been spent, but they belong to municipalities. There is no special report on village work, which so far as concerns epidemics is the most important, unless the improvements reported in *districts* can be accepted as such, but even with this qualification, it is quite safe to say that the work in districts is general in its character, while true village sanitary work is strictly local. There is one suggestion made by the Magistrate of Shahabad on this subject in which we entirely agree. He says, "I think "that the attention of Government might be drawn to the propriety of taking special sanitary action "in its own villages, and of assigning a per-centage on the rents for the purpose." If this course were followed health and life would be saved, and an example set forth that the Government meant what it advocated to be carried into action.

65. An important step in sanitary legislation was taken by the passing of the New Bengal Municipal Act of 1884, which appears to confer ample powers on the local authorities. The amended Poori Lodging-house Act was also passed. Another important Act, "The Bengal Local Government "Act," by which district wards will be appointed for sanitation outside municipalities, was passed in April 1883, and awaited sanction by the Supreme Government. So far as we can judge from the brief particulars of its provisions it might enable the District Boards to undertake village work; but there is rather more said about inspecting than is said about execution, for the one is of very little use without the other.

66. There is one matter connected with railway administration which the Sanitary Commissioner very properly says "requires the serious consideration of the Government," and this is the deplorable condition of the water-supply at many stations, a defect easily remedied, and if this water has any relation to liability to cholera among Native passengers, it surely ought to be at once superseded by a wholesome supply.

67. Another urgent matter dwelt on by the Sanitary Commissioner is the present state of law and practice for disposal of the dead. It appears to be a general practice, chiefly among Mahomedans, to bury dead within the precincts of villages, or even within houses. It is obvious that procedure of this kind in an epidemic country ought not to be allowed. Among other Native communities dead bodies are simply thrown into rivers, to the danger of the public health. Remedies for both practices might surely be discovered and applied.

68. *Personal proceedings.*—Under this heading and its appendices is given a detail of inspecting work done by the Sanitary Commissioner and his staff, which includes a large amount of useful information on the present condition of the places visited. Dr. Lidderdale himself inspected 27 municipal towns. The seven Deputy Sanitary Commissioners inspected 2,712 villages in 1884, and the eight Deputy Superintendents of Vaccination inspected 2,574 villages. It is satisfactory to be told that no more than 205 villages showed signs of retrogression. A large number of villages was inspected by subordinate officers, but the results are not considered of sufficient importance to be quoted.

69. We have already given an extract from a report by Dr. Ghose, who appears to have devoted much attention to this inspecting work, for he not only describes the defects which came under his notice, but, so far as we can judge, he has traced them to their causes. For example, he tells us that an area of country within which the stations of Dum Dum and Barrackpore are situated was at one time inhabited by a flourishing population, but within the last 30 years or so this tract of country has become very malarious, a result which he considers to have been caused by derangement of the whole water and drainage system by partial silting up, and the discharging channels have been interfered with by a series of embanked roads and railroads, so that the free passage of water to the salt-water lakes has been impeded. "The whole area has thus been converted into blocks of "marshes, the culverts and bridges acting only when the country is overflowed." If this view were confirmed by special engineering inspection, it would go to show that the present drainage outlets allow only the wholesome part of the inundation water to escape, while the malaria producing portion is retained.

Dr. Ghose moreover tells us that "no village can be said to have a supply of pure drinking water." This statement condemns the sanitary condition of the soils, subsoils, and surroundings of the villages, because on these depends the sanitary state of the water-supply, and he sums up the results of his inspections in the following words:—"From my observations I am of opinion that want of drainage "and bad water-supply are the general and crying evils of all these districts. The former has made "malarial fevers and the latter cholera the endemic diseases of the country;" the bad water being, as we have said, an index to generally polluted site.

70. There is a large amount of detail in the other reports of a similar kind, giving with more fulness the sanitary state of the villages. There is a sad uniformity in all of them. But the one consolatory fact is that, excepting the cases in which disease is due to the condition of the tracts of country within which these villages are situated, there are no local disease causes in the villages which could not be removed by the people themselves and without costly sanitary works. If cholera, small-pox, and fevers only affected a village by itself and left the country free, there might be some possible argument for non-interference, but the epidemic history shows that the great losses of life which tend to impoverish the country directly or indirectly are simply the results of the aggregate influences of single village outbreaks. The causes are local and the results general. This is the law revealed by statistics, and these sanitary inspections, which have been ably conducted by the Sanitary Commissioner and his subordinates, have led us directly to the causes with which Government and its executive officers have to deal. This is the final result of the Report for 1884.

71. Before concluding, we may refer briefly to a report on the suburbs of Calcutta by two of the Native Deputy Superintendents of Vaccination. In this report they have clearly localized disease causes which have made the large population inhabiting the suburbs proverbial for their liability to epidemics. There is, however, nothing in the report which has not been discussed by us in former years, but what it does do is to strengthen the evidence for the necessity of extending the Calcutta Municipal Acts over the entire area, for the work is of such a nature as to preclude its being done bit by bit by the local agencies.

Lastly. The sanitary defects exposed in the Report, and the great losses of life consequent on their existence, have, we fear, consigned the good work actually done to a subordinate position in this review. And we desire, in conclusion, to express our satisfaction with this work within the very limited area which it has as yet covered.

The facts we have given show how deeply the public health and economic interests of the vast population of Bengal are involved in prosecuting these improvements over the whole country, and they clearly show the need of a more efficient sanitary executive, such as was provided for in the way of recommendation by the Royal Commission on the sanitary state of the Indian Army nearly a quarter of a century ago.

25th May 1886.

No. 5.

Memorandum of the Army Sanitary Commission on the Report of the Sanitary Commissioner for the Punjab for 1884.

1. The population element used in this Report is that of the census of 1881, namely, 18,842,264. The registered births in 1884 were 809,912, which yielded on the census population the high birth-rate of 42·98 per 1,000; this, however, is only a mean of 32 registration districts in which the lowest registered rate was 18·91 per 1,000 in Peshawur district, and the highest 53·53 per 1,000 in

Sialkot. But the really lowest birth-rate was 12·04 per 1,000 in Simla, marking apparently the uncertain nature of the population element there, while in the other districts no allowance can be made as yet for increase of population since 1881, because the rate of increase in the districts is not known; consequently the birth-rates are generally too high.

2. The deaths registered in 1884 were 660,298, yielding a death-rate on the population of 1881 of 35 per 1,000, which is likewise a mean of 32 district rates, the lowest being 14 per 1,000 in Peshawur, and the highest 66 per 1,000 in Ludhiana.

The proportional ratios between the sexes were 114·77 male births for 100 females, and 109·12 male deaths for 100 females.

3. The death causes in 1884 were as follows:—

Diseases.	Deaths.	Deaths per 1,000.
Cholera	614	0·03
Small-pox	16,416	0·87
Fevers	465,556	24·74
Bowel complaints	16,346	0·97
Injuries	5,512	0·29
Other causes	153,854	8·16
All causes	660,298	35·03

4. As will be seen, cholera was by much the least fatal death cause in the Punjab in 1884. For every death from cholera there were about 27 deaths from small-pox, and 758 from fever. This subject of comparative mortality is of great importance in epidemiology, and we shall here give the deaths from each disease for a series of years, taking for granted that the registration errors have not varied materially.

Years.	Registered Deaths.		
	Cholera.	Small-pox.	Fevers.
1868	532	23,759	151,337
1869	9,258	58,195	272,956
1870	469	27,163	275,093
1871	266	25,834	213,548
1872	8,727	23,738	264,711
1873	148	25,699	219,909
1874	79	12,026	190,613
1875	6,246	13,611	279,825
1876	5,738	10,254	351,286
1877	22	12,296	219,281
1878	213	40,271	440,492
1879	26,125	32,489	472,939
1880	274	9,145	327,727
1881	5,207	6,749	355,279
1882	39	6,379	346,680
1883	190	12,103	306,164
1884	614	16,416	465,556
Total	64,152	378,127	5,153,396

5. The following results of this table are of importance, for we learn from it that of the total deaths from these three epidemic diseases, no more than 1·13 per cent. were due to cholera, 6·67 per cent. were due to small-pox, and above 92 per cent. to diseases classed as "fevers."

6. It will also be observed that the two first epidemic diseases, cholera and small-pox, are very irregular in their incidence and in the mortality they occasion from year to year, while the proportions of deaths assigned to fever, although also variable, are not so much so as the death-rates from the other two diseases. All three are subject to rapid augmentation and decline in particular years and groups of years.

7. We have not the data for 1867, which was one of the great Hurdwar fair years, for the three diseases, but in that year 43,146 people died of cholera. This great epidemic was assigned to the fair and its results, but many years ago we showed by the statistics that the disease underwent increase all over the north of India at the time. The preceding table allows us to introduce a correction for the next great Hurdwar fair of 1879, for it shows that although there was a great augmentation of cholera mortality in that year, it was accompanied by a still greater increase of the small-pox and fever mortality, insomuch that the deaths from fever were the highest in any year of the series; the small-pox deaths were also the most numerous, with one solitary exception, and cholera deaths were also the most numerous. The average annual mortality during the 17 years in the table from the three diseases amounted to 328,863, while the deaths from the same diseases in the Hurdwar fair year, 1879, were 548,553. The increase of cholera deaths was a very small matter indeed, when compared with the total epidemic increase of the fair year. It seems not unlikely that there are years of periodic increase of epidemics all over the country; anyway we should scarcely be justified in assuming the Hurdwar fair as a *vera causa* of the enormous increase of small-pox and fever mortality during the year when it was held.

8. The cholera mortality of 1884 amounted, as has been shown, to 614 deaths, of which 577 took place in country districts, and the remaining 37 in towns. One of the most singular facts about this cholera was its distribution. There were single deaths at long distances from each other, as if to show that the disease covered the whole country, while the disease was active only over limited areas. Thus out of 32 districts, 21 escaped entirely. Six districts yielded each one death. One district returned 2 deaths, one returned 7, one 12, another 24, facts which show the distribution, but not the intensity, which was reserved for Kangra district, where out of a population of 727,006 there were 526 cholera deaths. A similar distribution took place in the towns, 8 of which out of 49 yielded all the deaths, 37 in number. But of these, 17 deaths were yielded by Delhi and its suburbs, and 13 by Jullunder and its suburbs. All the cholera deaths of the year were returned from 26 registration circles out of 444 in the province, and from 97 villages out of a total of 35,972.

9. Tried by any of the usual standards, no account can be given of the facts. Here we have a case in which the same defective conditions as to water, drainage, deficient cleansing, intercourse between affected and unaffected localities, infective influence, if such there be, existed as usual, and the statistics show that cholera was over the country, and yet it swoops down on one district only, and we shall now see whether in this district there was an added condition which may fairly be assumed as a cause of these purely local facts. And first, as regards the seasonal incidence of cholera, which was as follows:—

Months.	Cholera Deaths.	Months.	Cholera Deaths.
January	1	July	39
February	—	August	141
March	2	September	29
April	—	October	—
May	218	November	4
June	178	December	2

This table bears marks of a distinct epidemic during the months May to September inclusive. It was limited to 605 deaths, and of these deaths, in the same months, 521 took place in Kangra district. There are in this district 15 circles of registration, 8 of which returned deaths from cholera, and out of 651 villages in it 71 suffered. The cholera death-rate was 0·72 per 1,000 against a previous five years' average rate of 0·56. The only remark which the Sanitary Commissioner has been enabled to make on this outbreak is that the Civil Surgeon was unable to furnish a history of it. The case is, nevertheless, of great importance in epidemic history, and there can be little doubt that there were causes, very probably atmospheric causes among others, which determined the incidence of the disease.

10. Kangra district was not the only one attacked in the same region of the Punjab, for the epidemic showed its presence in Simla and Jullundur districts, in the former of which there were 24, and in the latter 25 deaths. These deaths took place during the same months as those in Kangra, as did also 17 deaths in Delhi. With the exception of a few detached single cases, it would be quite in consistence with the statistical facts to say that the cholera epidemic of 1884 took place within defined boundaries in a small area on the eastern hilly side of the Punjab, while the remainder of the province escaped.

11. We have no information as to the condition of attacked villages in Kangra. But in the Simla cases, some of them at least appear to have been connected with a marriage procession which passed through an epidemic region without any sanitary care. There were many thousands in the procession, which in some respects resembled an ordinary insanitary fair, and the medical officer who drew up the history tells us that the villages were very dirty.

12. The opinion expressed by the Civil Surgeon regarding the Delhi outbreak of 17 deaths is that the disease was imported, because travellers were seized, but this is not borne out by the facts, and requires no further notice.

13. *Small-pox* was a far more extensive and fatal epidemic than cholera. It covered more or less all the 32 registration districts. Deaths from it were returned from 334 out of 444 registration circles, and 4,232 villages out of 35,972 suffered. Deaths from it were returned from 38 towns out of 49. The village death-rate taken over the whole population was 0·86 per 1,000, and the town rate was 1·07 per 1,000. The severity of the disease varied greatly in different parts of the country, as is shown by the fact that in Shahpur the death-rate was 0·005 per 1,000, while in Kurnal it reached the very high rate of 4·20 per 1,000. This rate was exceeded in certain towns, in two of which, Umballa and Jagadhri, the rates were 5·77 and 5·87 per 1,000 respectively.

14. The deaths according to age stood as follows:—

	Total Deaths.
Under one year	4,713
One and under twelve	10,772
Adults	931

The registered monthly mortality was:—

Months.	Small-pox Deaths.	Months.	Small-pox Deaths.
January	1,523	July	1,749
February	1,659	August	1,035
March	1,552	September	553
April	1,873	October	347
May	2,786	November	279
June	2,645	December	424

Reference to a previous table will show the relation of the small-pox epidemic to the epidemics of previous years, and we shall now show its relation to the vaccination service.

15. The staff for the official year 1884–85 consisted of—

Deputy Sanitary Commissioners	2
,, Superintendents of Vaccination	1
Native Supervisors	33
Vaccinators	280

And the year's work performed by this staff was,—

Successful primary vaccinations	537,951
,, re-vaccinations	6,542
Total	544,493

We have already given the registered births as 809,912, so that the successful primary vaccinations were a little more than five-eighths of the births. But, as a matter of fact, the successful primary vaccinations at ages under one year were 406,858, or, as near as may be, half the births. The ratios of vaccinations to deaths during the preceding five years have been as follows:—

Ratio of successful vaccinations per 1,000 of population	20·30
Deaths from small-pox per 1,000	1·14

If the population continued to live for the next half century without any addition by births, it would be by that time protected, and this merely shows how inadequate the work done is to the emergency. We are glad to know that of recent years the service has been greatly improved, and that the annual mortality table already given appears to show that good results have been already attained. But the practical result of all the past experience appears to be that, while the tendency of the disease to take on the epidemic character must be met by improving the sanitary condition of the people and of the localities they inhabit, the vaccination work must be more specially directed to protecting infantile ages, when most good may be done in the way of warding off attacks of the disease in after life.

16. *Fevers.*—The Sanitary Commissioner states that "more than two-thirds of the total mortality "were attributed to this cause." All the districts and all the towns suffered. In the districts, 436,260 fever deaths were registered, and 29,978 in the towns. The district fever-rate was 24·85 per 1,000, and the town rate 22·88 per 1,000. The fever death-rate for the whole province, town and country, was 24·71 per 1,000. No better proof of the universality of fever mortality in 1884 could be adduced than the fact that all the 444 circles of registration returned deaths, as did also 31,828 villages out of a total number of 35,972 in the province. A reference to the annual epidemic table already given will show that, with the single exception of the scarcity year 1879, the fever deaths registered in 1884 greatly exceeded those of any preceding year, while it also affords evidence that fever in the Punjab is becoming a more fatal disease than it was.

It is necessary, however, at the same time, to repeat what we have often said, that the diagnosis of fever is far from being trustworthy, while part of the augmented mortality may be due to improving registration.

17. The following abstract shows that fever mortality was high in all the months of 1884, but highest during the four last months of the year:—

Months.	Fever Deaths.	Months.	Fever Deaths.
January	23,829	July	21,500
February	23,564	August	24,384
March	22,437	September	45,530
April	22,227	October	164,761
May	28,509	November	76,985
June	25,546	December	47,384

If we could compare with certainty the fever-rates of different years, the result in 1884 would be unfavourable to the public health, for the previous five years' rate for the whole province, which had been 20·15 per 1,000, was represented in 1884 by a rate of 24·71 per 1,000. The death-rate varied greatly in different districts. The lowest rate of the year was 9·42 per 1,000 in Peshawar, but in 12

districts the fever-rate exceeded 20 per 1,000. The highest rates of the year were 45·12 per 1,000 in Umballa, and 52·95 per 1,000 in Ludhiana.

18. In attempting to trace the causes of this very fatal fever outbreak, the first point is to show what relation existed between the seasonal rainfall and the mortality from fever. As the first element is an average one, we shall place it alongside the fever deaths for the same months :—

	Rainfall. Inches.	Fever Deaths.
First quarter	2·8	67,830
Second quarter	3·8	76,582
Third quarter	19·4	92,014
Fourth quarter	0·9	229,136

It is clear from this abstract that the great fever mortality of the year followed the heavy rain of the third quarter. The figures, of course, include the whole country, but we can localize both the fever deaths and the rainfall, and by doing so we shall obtain a clearer view of the relation which existed between them.

19. For this purpose, we may select the examples of Peshawur, Umballa, and Ludhiana already given :—

Quarters.	Peshawur.		Umballa.		Ludhiana.	
	Rain Inches.	Fever Deaths.	Rain Inches.	Fever Deaths.	Rain Inches.	Fever Deaths.
1st	6·3	1,896	0·1	3,109	0·9	2,026
2nd	2·9	1,328	2·7	4,055	2·7	2,588
3rd	4·5	1,066	41·2	10,845	22·5	6,004
4th	0·1	1,791	1·9	30,160	1·1	22,149

This abstract shows very clearly the influence of rain distribution on fever. It may be taken for granted that all the local predisposing conditions remained much as usual, but, as a fact, fever increases very greatly with increase of rain, and this is shown even in Peshawur district, where the largest quarterly fever mortality followed so small a rainfall as 4½ inches in a quarter of a year. This result would appear to show that in all the cases cited some other agent was in action, and, in all probability, this was low and variable temperature. Any way, atmospheric causes are beyond our control, and we can only deal with a certain portion of their effects, and belonging to these are results of heavy rain, acting on undrained and water-logged ground, of which the following illustrations are given in the report. We shall first take Ludhiana district, with its fever death-rate of 52·95 per 1,000.

20. "In this district fever was evidently malarious, of the intermittent and remittent types. The "district of Ludhiana is partly situated along the banks of the river Sutlej, which bounds it on the "north-west, and the Sirhind Canal traverses it on the south-east; from these sources there is con-"siderable irrigation conducted over the surface of the country, and consequently the climate is "damper and more malarious than before. Besides these changes in the climate, it is the custom of "most of the natives, especially the poor, to sleep outside in the autumn months, and they thus "expose themselves to the unusual chills of the night air, and in most instances with very insufficient "clothing."

21. The fever death-rate of Umballa, as we have seen, was 45·12 per 1,000, and the following account of the district is given :—"Autumnal fevers of a severe and prostrating type prevailed after "the unusually heavy rainy season, producing excessive mortality. . . . . The disease "is attributed to the water-logging of the country, the standing crops preventing evaporation and "quick drying up of the soil, and helping to keep up the malaria." The only remark called for by the latter clause of this statement is that the amount of water supplied to the crops ought to be no more than is required for productiveness, and with a subsoil in the condition described there must necessarily be fever, and not only so but the vegetation will also suffer, and consequently the productiveness.

This Umballa fever was mainly due to the addition of large rainfall to an undrained country.

22. *Karnal*, with its district fever-rate of 40·38 per 1,000, and its enormous town fever death-rate of 70·42 per 1,000, affords a striking illustration of the influence of rainfall acting through local conditions. Its rainfall for the four quarters of 1884 was 0·5, 6·2, 32·6, and 1·5 inches respectively. Of this epidemic fever it is said that "its severity has been most marked in the city of Karnal, and "generally in the Karnal tahsil. The reasons are very obvious in the facts that it is in this portion "of the district the natural drainage of the country is so obstructed, and huge *jhils* produced by the "action of the old Western Jumna Canal. The state of Karnal city during the months of September "and October was deplorable indeed. Hardly an inhabitant, I suppose, escaped fever during the "epidemic, and death must have visited almost every family," says the Deputy Commissioner.

"The whole rural population of the canal country was more or less prostrated, and that even of "the dry tracts to the west suffered greatly. No mention of a great epidemic like this should be made "without referring to the chief cause of malaria, namely, the complete obstruction to drainage for miles

" and miles throughout the Karnal and Panipat tahsils by the old Western Jumna Canal and its " numerous watercourses which lie between the crest of the ridge on which the new canal runs and " the Jumna bed."

It is, however, satisfactory to learn that the subject was in the hands of the Irrigation Department for remedy.

23. The high fever death-rate in Delhi of 36·54 per 1,000 is attributed to the heavy rainfall of the middle half of the year, when all the rain, 42·2 inches in amount, except ·1 fell. "The parts of the " district most seriously affected were the canal-irrigated tracts and the parts adjacent to the " Najafgarh *jhil*." In the dry and mountainous parts of the district, where the wells are generally " sunk in the rock and are less liable to surface infiltration, the epidemic prevailed with less " severity."

24. In Ferozepore district, where the fever death-rate averaged 33·30 per 1,000, the parts which suffered most were those which have " within the last few years been brought under canal irrigation."

25. Other cases are mentioned in which, in the absence of irrigation works, the natural drainages of the country appeared to be insufficient to dispose of unusual rainfall, or where unusual rise of the rivers from rain probably backwatered the subsoil. One of these instances is Mooltan, which, although enjoying almost complete exemption from cholera, suffered greatly from fevers in 1884, and it is stated of the inhabitants of these portions near rivers that "scarcely a soul escaped." Great mortality occurred all over the country among children, and much disease was left among those who had passed through the fever.

26. No mention is made in the reports of the sanitary condition of affected population groups, but it may be taken for granted that this did not differ materially from the condition of preceding years. Intermittent fever is not a fatal disease in its simpler forms, and its death-rate may be safely assumed in part at least as indicating the sanitary state of dwellings and the localities which they occupy. But the main lesson taught by the facts is that in districts where paroxysmal fevers are always more or less present, and due to a damp malaria-generating condition of the country, the addition of irrigation water without drainage, obstructions of natural drainage by works, and added rainfall sufficient to water-log the subsoil over large areas may convert a simple fever into a highly dangerous epidemic.

27. The practical teaching of the year's experience is that more activity is required in improving the sanitary condition of villages, including the draining and general improvement of village sites, and that these district fever rates should be studied with reference to the influence of drainage defects on the public health, and the means of their removal, so far as this may be practicable. The impression produced by the facts as a whole appears to be that while the extent of fever prevalence was due to general causes, its severity of type and its fatality, as is the case generally, were mainly due to the insanitary conditions of inhabited villages and houses.

28. *Bowel complaints.*—The deaths under this head were 18,346, or in the ratio of 0·97 per 1,000, against a previous five years' average of 1·10 per 1,000. The mortality was generally diffused over the province, and was returned from 415 out of 444 circles of registration, but its incidence was local for all the deaths were registered in 4,179 village out of 35,972.

The bowel-complaint deaths, registered month by month, were as follows:—

Months.	Bowel Complaint Deaths.	Months.	Bowel Complaint Deaths.
January - - -	925	July - - -	1,134
February - -	799	August - - -	1,644
March - - -	833	September - -	2,068
April - - -	1,115	October - -	2,652
May - - -	1,527	November - -	2,481
June - - -	1,284	December - -	1,884

It is worthy of remark that the months of maximum mortality from bowel complaints corresponded with the months of maximum mortality from fevers.

29. *Injuries.*—Under this head were registered 128 suicides in males and 189 in females. There were 2,342 fatal accidents among males and 1,391 among females. Snake bites and wild beasts occasioned 758 deaths among males and 349 among females. The actual deaths from snake bites were 900 in 1884 against 1,189 in the previous year. All the districts returned deaths under this head. Simla returned only one snake-bite death, while Sealkote returned 72 and Gurjranwala 78.

Hydrophobia occasioned 158 deaths, and of deaths from wild beasts 10 were by jackals, 2 stings of scorpions, 7 by wolves, 6 by boars, 1 by a bear, and 6 by tigers.

All other causes.—Under this head were registered 153,854 deaths, but of this number the Sanitary Commissioner has assigned 32,916 as having been due to cough and chest diseases.

30. *Sanitary works (civil).*—Under this head it is stated that the drainage of the Dera Ghazi Khan cantonment was completed, or would be so early in 1885.

31. The water supply of Simla was expected to be completed at the date of the report. There are two reservoirs, one for two millions of gallons, the other for 1,180,000 gallons storage. The yield will be 4½ gallons per head per day for 16,000 people, and the cost has been 1,77,810 rupees.

The drainage of Simla was still incomplete, and the plan proposed for collecting the sewage at depôts and washing it down pipes to an outlet below the waterfalls had not been carried out as yet, and when completed, if it ever be so, it is satisfactory to learn that the Local Government cannot accept it as a permanent one. Would it not be worth while, instead of experimenting in a matter of this kind, to appropriate funds once for all to place the seat of Government beyond all risk permanently by removing the sewage to such a distance as to be out of harm's way, and to make the station a model of sanitary work?

32. The drainage works for relieving the subsoil of the city of Amritsar and its vicinity, including filling up of the town ditch, were making rapid progress towards completion. It is perhaps worthy of remark that this district and city, which suffered so greatly from fever a short time ago, proved to have been connected with a thoroughly water-logged condition of the country, had a fever-rate for the district of 20·82 against a previous five years' rate of 21·87 per 1,000, while the town fever-rate was 19·14 per 1,000, and this in the presence of the great fever epidemic of 1884.

33. Schemes for the drainage and water supply of Delhi had been prepared at Bradford under the superintendence of Mr. Binnie, and had been submitted to Government for approval. The water-works scheme had been approved at an estimated cost of Rs. 10,10,279. But the scheme of drainage, the estimate for which was Rs. 4,01,122, was still under consideration. No details of either scheme was given in the report. In the course of the year drainage works had been forwarded in the suburbs of Delhi.

34. Plans and estimates for the drainage of Hoshiarpur had been sent in to Government for sanction.

35. A project for a circular drain for the city of Sialkote had been sanctioned.

36. The drains and wells of Rawul Pindi had been repaired and cleaned, and a project for bringing water into the town from a distance of eight miles had been prepared.

37. The saucer drains for Peshawur had been completed, but the water-supply rests where it was.

38. These are the chief works of the year. But "from the annual reports received from the "district officers it appears that a great number of minor works, such as erection of latrines, "construction of roads, drains, and bridges, &c., were carried out in all the municipal towns of their "respective districts."

The expenditure on sanitary work of one kind or another in the 32 districts of the province stood as follows:—

	Rs.
Conservancy	4,28,297
Paving	60,592
Roads and bridges	1,39,759
Drainage and sewerage	91,908
Water-supply	1,22,678
Latrines	10,277
Other sanitary objects	18,726
	9,22,137

equal to 32 per cent. of the income.

39. It is satisfactory to learn that part of the outlay has been recovered in all the districts from the sale of manure.

The following have been the amounts received for the last five years:—

	Rs.	A.
1880	49,944	8
1881	18,785	8
1882	61,646	1
1883	68,968	3
1884	75,695	0

These figures show that there is a fund available for sanitary improvement which admits of large augmentation if a little attention be devoted to the matter.

40. *General remarks and personal proceedings.*—Under this head the Sanitary Commissioner informs us that, in the month of April 1884, the Local Self-Government Act was introduced into the Punjab, and that municipal committees and district boards were organised under the elective system, and all matters connected with local sanitation were vested in them as part of their work. In consequence of this administrative change the Sanitary Commissioner considered it to be advisable to visit all municipal towns, such of them, at least, as could be reached by railway (20 were visited), with the object of meeting the committees and impressing on them the importance of maintaining in full efficiency the various sanitary measures and regulations which had already been established. He met the committees and other leading people, and, after inspecting the locality, he addressed them on the public health subject, with special reference to the measures of improvement needed in the town. As Mr. Bellew is well acquainted with the nature of disease causes, and with the most practical method of dealing with them, it may not be out of place, for information, to give his views, very briefly, on what it is possible for the new local authorities to do.

He gives the first place to *cleansing*, as the most effective agent in protecting the public health; hence the necessity of organising and maintaining an efficienet conservancy staff in all towns. He impressed on them the fact "that it was owing to faulty and neglected scavenging that the breathing "air and drinking water of the towns were so generally and so seriously deteriorated and polluted "by impurities," and he showed that the foul matters which led to such results had everywhere a certain money value, amounting in the Punjab to 7,500*l.* for the past year. He called attention to the necessity of domestic and personal hygiene, to the bad condition of town drains, which were laid without any consistent plan, and had their outlets in festering pools of sewage all round the outskirts, while, under proper methods of draining, the sewage could be removed to a distance and utilized.

He states that in the Punjab towns most of the tanks and wells have been improved externally, but that further precautions are required for keeping out subsoil impurities. In our "suggestions" we showed the simplest means of effecting this result.

The sanitary condition of house compounds and houses is, however, of more vital importance to the public health of Indian towns and villages than mere surface cleansing, and until the municipal authorities can find means of including this duty along with others in their daily work, they must not expect much real improvement. So far as we can see, they have no power at present to deal with the matter. The Sanitary Commissioner has, however, fully appreciated the necessities of the case, and he has taken an important step at the initiation of the new authorities to keep them in the right groove. They can do this cleansing work at once; but, in all the towns, there are engineering works, many of them simple enough, which may, nevertheless, be so carried out as to endanger the public health, and it is in this direction that both work and money may be saved by acting under skilled advice.

We are glad to know that the Government of Bombay has foreseen this need by appointing a skilled sanitary engineer, whose services are placed at the disposal of the municipal authorities as adviser in such cases. It seems a necessary consequence of the new municipal law that each Government should follow this example, for there is no doubt that much bad work, and consequent useless expenditure, would be prevented by skilled guidance.

In conclusion, it will have been seen that the disease history of 1884 has proved anew the danger to public health of undrained country under the influence of rain distribution. But there is one hopeful case, if we can accept the Amritsar experience for a year as leading up to it, and this is that merely local drainage work, even in an undrained country, may save health and life, and the lesson from it should be that part of the duty of those new municipalities ought to include the efficient subsoil drainage of town and village sites as essential parts of their work. Mr. Bellew advocates, very properly, town and village improvements in streets, house construction, ventilation, &c., as of importance. But, at the commencement, at least, of so great an administrative change as has been initiated there should be sufficient inspection, to see that the new authorities exercise the important trust confided to them by their fellow-citizens to the public advantage.

12th March 1886.

No. 6.

Memorandum of the Army Sanitary Commission on the Report of the Sanitary Commissioner of the North-West Provinces and Oudh for 1884.

1. The population on which the vital statistics of the North-West Provinces and Oudh are calculated in this Report consisted of—

Males	22,912,556
Females	21,195,313
Total	44,107,869

The same population element has been made use of every successive year since the census year 1881, and if there has been any increase since that year, the ratios for 1884 will of course be too high.

2. The births registered in 1884 were, of—

Males	1,015,699
Females	915,262
Total	1,930,961

equal to a birth-rate of 43·77 per 1,000.

3. The deaths for the same population were, of—

Males	823,620
Females	731,722
Total	1,555,342

equal to a death-rate of 35·26 per 1,000.

Hence the registered births exceeded the registered deaths by 375,619, showing a gain of 8·51 per 1,000 for a single year.

4. The lowest registered birth-rate of the year was 22·92 per 1,000 in Dhera Dun. The highest was 58·58 per 1,000 in Lalitpur, but the results in these two cases appear to have been related to the small populations of these districts. Generally, the returns show good registering work done under this head, and in some cases, perhaps, too well done, unless there is some error in the population element, which is not unlikely.

5. The lowest registered death-rate of the year was registered in Dhera Dun. It was 19·99 per 1,000, and it may be contrasted with a rate of 57·31 per 1,000 in Hamirpur, which yielded the highest rate of the year. But diversities of death-rates are connected with local epidemics, which are more fatal in some districts than in others. The death-rates generally show better registration in 1884 than in previous years, but it does not follow from this fact that the public health was worse in that year, or that, in the case of births, more children were born. But it is a perfectly safe deduction to make, that the registering machinery in these provinces has been improving.

6. The following were the deaths registered under the usual heads in 1884:—

Diseases.	Total Deaths.	Deaths per 1,000 of Population.
Cholera - - - -	80,148	0·68
Small-pox - - - -	202,541	1·59
Fevers - - - -	1,074,097	24·35
Bowel complaints - - -	76,508	1·73
Injuries - - - -	21,107	0·48
All other causes - - -	150,946	3·42
All causes - - -	1,555,342	35·25

7. We shall notice briefly the information given in the Report under each of these heads, beginning with *cholera*. And, first, it will be observed that, with the exception of "injuries," cholera was the least fatal death cause of the year. Small-pox was above six-fold, and fever above 35-fold more fatal, and yet cholera was diffused over nearly the whole area of the provinces, for out of 49 districts all returned deaths except five. Its manner of distribution may be further understood from the fact that, although thus covering nearly the whole area of the provinces, cholera deaths were returned from 653 registration circles out of 1,146, and all the deaths took place in 3,551 villages out of 105,421 within the affected area, and thus only about half the registration circles and about one village in 30 suffered. The cholera of 1884 was thus a universally diffused epidemic of low intensity, but, nevertheless, the attacked villages averaged nine deaths each. In this, as in similar cases, the death ratio when taken over the whole population is deceptive. The rate for 105,421 population groups was 0·68 per 1,000, but for the affected groups it may be estimated at about 20 per 1,000. This epidemic history, which is repeated every year in every Indian Government, includes the fundamental law of epidemics, namely, that, being present in any country, only a small number of the population groups suffer at the same time. There is no spreading from a centre to cover a larger neighbouring area. Only a certain number suffer, and then the shower falls elsewhere. In the course of a definite number of epidemic years, all may have furnished victims, but never all at the same time.

8. As we have seen in the present case, the 3,561 villages in which the epidemic cholera of 1884 showed its presence were scattered over nearly the whole area of the North-West Provinces and Oudh. But this widespread distribution of the disease is not inconsistent with another observed fact, namely, that although the distribution of epidemics may be general over a country, their severity may nevertheless be local. For example, in the present instance we have Saharanpur district with a population of 854,996, living in 1,605 villages and towns, only one of which furnished deaths, but these were 53 in number, out of a population of 22,116 in the town of Deoband. The cholera death-rate in this town was nearly 2½ per 1,000, while the rate in the remainder of the district was *nil*. At the other extreme we may place Hamirpur district, with a population of 492,858, in 735 groups, of which no fewer than 184 were attacked during the same epidemic, and the rate for the district as a whole was 6·13 per 1,000, the greatest of the year.

9. Related to this subject of epidemic distribution is a report by the Deputy Sanitary Commissioner on cholera in Banda district, in which an attempt is made to arrive at some explanation of certain apparently anomalous facts, which, as he observes, "would seem to indicate that, without local "inquiry, it is not safe to base deductions on the returns of large areas such as mortuary circles."

Banda contains a population of 670,912, inhabiting 1,166 localities, of which 181 were attacked by cholera in 1884. The death-rate from this cause was 2·32 per 1,000, against a previous five years' rate of 2·45 per 1,000. In this case certain circles were attacked in successive years, and one object of the inquiry appears to have been to examine whether the passage of pilgrims was connected with the successive cholera outbreaks. That pilgrims traversed the district is true enough, and it is also true that a number of them died of cholera, and, as a matter of course, in a district where cholera is always more or less present, there were deaths among the residents. But it does not follow that the residents died because of the pilgrims. The inquiry resulted in showing that 90 per cent. of the cases

took place in pilgrims who had arrived sick, and that the attacks of villages along pilgrim routes were subject to the same law of inconstancy in different years as other places. Thus the Deputy Sanitary Commissioner gives a table of 24 towns, lying along pilgrim routes and subject to this supposed risk, and the result is that, in 1882, the great Allahabad mela year, 13 towns had cholera and 11 had none. In 1883 there was cholera in 14 towns, and 10 escaped, and in 1884, 12 had cholera and 12 escaped. The result of this inquiry did not prove that the addition of pilgrims to unhealthy towns was a safe proceeding, for in the present state of Indian towns an added population of this kind is an added local disease cause, but it showed that the epidemic law, we have already stated, held good equally in cases where there were no pilgrims to increase the mortality.

10. The great practical lesson taught by both classes of facts is the same, and it is that the true safeguard in either case is to remove the localising epidemic causes, and at this point the report on Banda supplies us with facts of importance.

Sanitary notes are given on a number of towns and villages, and they all tell the same story of flagrant want of cleanliness, the presence of unwholesome trades in the centre of towns and villages, want of drainage, and bad and deficient water-supply, but the reporter very properly adds that he does not attribute the disease to the introduction of any *materies morbi*, but to "general contamina-"tion resulting from the passage into the well by surface and subsoil drainage of the filth recklessly "deposited in or about the inhabited site."

In one place, where 6 per cent. of the people died of cholera, the case was put by a resident Chamar as follows:—"Last year in the rains the water got bad, but now it had become sweet again, and the "people had commenced drinking it." In this instance the surroundings of the well were so foul that "the stench was well nigh unbearable." It is further stated, on the authority of the tahsildars and others, "that it is a common thing in the hot weather for the lower caste people to collect the remaining "dirty water in the nearly dried up tanks into holes dug for the purpose, and to draw their drinking "supply from thence. In many places so inadequate is the supply to the demand that people sleep "round the wells so as to anticipate others in obtaining their daily supply." Another very important local disease cause in villages built on hill slopes is the practice of using the barren ground above the village as a place of deposit for filth, and during the rains the foul matter is washed down to the village and its wells, to endanger the lives of the people. With such facts observed on the spot by competent officers, there is no room for dealing with the pilgrims except to advise them, for their own safety, to keep out of such places. The case, in fact, has passed out of the hands of the sanitary officer into those of the executive, with whom must rest the responsibility for the existence of such a state of matters. But this report has a further value in showing the supreme importance of making detailed sanitary inspections of epidemic localities instead of trusting to general impressions as to epidemic disease causes.

11. We shall return afterwards to the question of local sanitary condition as related to epidemics, and we may here introduce the monthly data for cholera in 1884, which stood as follows:—

Months.	Cholera Deaths.	Months.	Cholera Deaths.
January	108	July	3,340
February	34	August	6,734
March	102	September	5,655
April	1,124	October	3,273
May	3,628	November	790
June	5,117	December	182

There was thus a complete epidemic in these provinces. As already stated, the cholera death-rate for the whole province was 0·68 per 1,000, but for the towns it was 1·73 per 1,000.

12. *Small-pox.*—The mortality from small-pox in 1884 was a very different matter from the mortality from cholera. It was, in fact, a great epidemic visitation during which 202,541 people perished. There are records of deaths from this disease in the last 15 years, and the death-rate in 1884 was 4·5 per 1,000 of the inhabitants, by much the highest death-rate within the period. The culminating year of the preceding epidemic was the scarcity year 1878, during which the rate was 3·9 per 1,000. In 1880 the small-pox death-rate, 0·1 per 1,000, was the lowest recorded rate. In 1881 the rate was 0·3, in 1882 it was 0·6. In 1883 it had increased to 3·1, and in 1884 the great death-rate of 4·5 per 1,000 was reached.

13. Small-pox prevailed in all the 49 registration districts with two exceptions, Gharwál and Meerut. In two districts the rate was 0·1 per 1,000, which was the lowest, and in the following districts, where the disease was most severe, the mortality was very high:—

Districts.	Small pox Deaths per 1,000.
Gonda	19·35
Bahraich	19·16
Pártabgarh	18·18
Rae Bareli	13·76
Basti	11·81
Sultanpur	10·69

Besides these rates, there were 25 districts in which the rates were between 1 and 8·87 per 1·000, affording sufficient evidence of the extent and severity of the epidemic. The statistical exceptions already stated of Gharwál and Meerut were, however, only apparent, for there were 11 small-pox deaths registered in the former district and 27 in the latter, hence the epidemic of 1884 covered the entire area of the North-hWest Provinces and Oudh.

14. A further analysis of the facts shows that, out of 1,146 registration circles, 943 yielded small-pox deaths, and out of 105,421 villages, no fewer than 42,663, a very high proportion, suffered, as did also 82 towns out of 102. The death-rate for the towns was 2·18 per 1,000, and for the village populations 4·59 per 1,000. The town death-rates varied as much as those of the districts, but the greatest proportional mortality of the year was yielded by Tanda, a town of 16,594 inhabitants, in which there were 453 deaths from small-pox, equal to a rate of 27·29 per 1,000. This town yielded a death-rate of no less than 64 per 1,000 from all causes.

15. The monthly prevalence of small-pox was as follows:—

Months.	Small-pox Deaths.	Months.	Small-pox Deaths.
January	10,607	July	12,847
February	15,055	August	3,718
March	32,452	September	1,085
April	50,506	October	503
May	48,185	November	373
June	25,633	December	625

This table shows a great epidemic outburst during the hot months, followed by rapid decline. But the epidemic had come over from the preceding year, as the facts show. Unfortunately there are no means of obtaining the ages of small-pox deaths, so that no relation can be established between the vaccination service of the year and the small-pox mortality, except very generally.

16. *Vaccination.*—From tables in the Report it appears that, during the last six years, the births in these provinces had amounted to a total of 9,784,696, while the successful vaccinations during the same period had been 3,577,106, or about a third of the births for all ages.

During the official year 1884–85 the vaccinations were as follows:—

Under one year	294,583
One and under six	233,608
Total of all ages	563,864

But the births registered in 1884 were 1,930,961, which number represents approximately the number available for vaccination at the time when its protective power is most useful, and it is not improbable that the very small ratio of about 15 per cent. of the numbers born who came under the charge of the vaccinator may afford a partial explanation of part of the great mortality of the year. But the facts already stated show conclusively that the small-pox of 1884 was one of the most severe epidemics on record, and by far the most severe in those provinces since deaths were registered. We are thus brought face to face with the fact that, notwithstanding the existence of an active vaccination service, small-pox swept over the provinces just as if there had been none. No doubt attacks and deaths had been prevented by the service, but it is clear that it has been incompetent to deal with the disease in its epidemic form, as the following list of vaccination officials will show:—

Superintendent General	1
Deputy Sanitary Commissioner of Circles	3
Deputy Superintendents	7
Native ,,	50
Vaccinators, 1st Class	279
,, 2nd ,,	331
Chaprasis and other servants	64
Total staff	785

As a matter of fact, the total vaccinations at all ages performed by this staff amounted to less than three times the number of deaths, and the operations under one year of age were not one and a half times the total deaths. These remarks are not intended to call into question the utility of vaccination. But in presence of the facts the question is a perfectly relevant one, namely, whether dependence can henceforth be placed on vaccination as a protection against a small-pox epidemic? The question of course answers itself. In ordinary years lives are no doubt saved, and lower small-pox death rates may be co-existent with numerous operations. But this and similar experience appears to show that the remedies, if such be available, will have to be extended beyond vaccination, and will have to deal with epidemic causes affecting localities and their inhabitants. If sanitary work be neglected, no more dependence against small-pox epidemics can be placed on vaccination than can be placed on quarantine against invasions of cholera. The true remedies lie elsewhere altogether.

17. *Fevers.*—As has been already stated, the deaths under this head amounted to 1,074,097, equal to a death-rate of 24·35 per 1,000. But, as has been long known, the classification rests on no scientific basis. All we know is that so many deaths were registered under this heading. The following monthly fever deaths were registered in 1884 :—

Months.	Deaths from Fevers.	Months.	Deaths from Fevers.
January - -	64,595	July - - -	66,311
February - -	59,006	August - - -	83,832
March - - -	70,288	September - -	103,342
April - - -	76,619	October - -	150,880
May - - -	84,428	November - -	133,285
June - - -	79,140	December - -	101,401

18. Fever deaths were registered in all the districts and in all the 1,146 registration circles, with only 25 exceptions. The number of attacked villages is not given in the returns, but, with such a distribution of the disease, it is probable that very few escaped. All the towns returned fever deaths. Their death-rate was 27·54 per 1,000, while that of the village population was 24·35 per 1,000. This rate was a shade lower than the previous five years' average, which was 25·54 per 1,000. The highest fever death-rate of the year, 45·47 per 1,000, was returned from Terai district. One of the irrigated districts, however, Saharanpur, had a rate of 48·28 per 1,000, exceeding the rate of the fever Terai itself.

19. There is nothing new to report on the fever etiology of 1884. As usually happens the irrigated districts with heavy rainfall always suffer severely. In 1884 the fever death-rate of 12 canal irrigated districts averaged 36·33 per 1,000, against a provincial rate of 24·35 per 1,000. The two agencies which appear to have contributed to this result are stated to have been raising the spring level many feet by canal irrigation, accompanied in 1884 by excessive rainfall, which was 10½ inches above the average.

Of course the local insanitary conditions to which these fevers owe so much of their fatality remained as they were usually, and we have in these facts a sufficient account of the year's fever causes. We have drawn attention to both causes and remedies year after year, and the fever causes are still as operative as ever.

20. *Bowel Complaints.*—Deaths attributed to these causes numbered 76,508, or 1·73 per 1,000 against a previous five years' average of 1·79 per 1,000. These diseases prevailed in all the districts, and in 1,076 circles of registration out of 1,146. The attacks appear not to have been returned by villages. Bowel complaint deaths were returned from all the towns with two or three exceptions, and the death-rate from them was 3·71 per 1,000, or double the district rate. Their monthly incidence was as follows :—

Months.	Bowel Complaint Deaths.	Months.	Bowel Complaint Deaths.
January - - -	4,060	July - - -	5,668
February - -	3,549	August - - -	8,998
March - - -	4,221	September - -	9,424
April - - -	5,353	October - -	9,548
May - - -	5,974	November - -	7,925
June - - -	5,867	December - -	5,891

The wet and variable months appear to have predisposed the people to bowel complaint attacks.

21. The epidemic history of the North-West Provinces and Oudh may be resumed briefly as follows. The epidemic death-rate was 31·35 per 1,000 in 1884, as against 29·61 per 1,000 as the previous five years' average rate. The death-rates from cholera, fevers, and bowel complaints were all under the average, but the small-pox death-rate was 3·41 per 1,000 above the average, and, being so, after clearing away the saving of life from these lower rates, it brought into the account an increase of the total epidemic rate of 1·74 per 1,000.

22. *Injuries.*—Under this head 21,167 deaths were registered, equal to a ratio of 0·48 per 1,000. Among them were 2,090 suicides, of which 1,546 were females. From wounds and accidents there were 12,924 deaths, and 6,093 from snake-bite and wild beasts. There has been a slight decrease under the last head.

23. *All other Causes.*—Of the 150,946 deaths entered under this head nothing except their registered numbers is known.

24. The disease history of 1884 is wound up by a very important and practically useful table showing the death-rates of the year from small-pox, fever, and cholera in each of the 1,146 circles of registration, together with the population in 1881 of each circle. This we must hope will in future be an annual table, and together with the preceding data it will always render available the facts of

each small area in the provinces for sanitary purposes. We learn from it the great differences which exist between adjoining population groups in their liability to epidemic attacks, and these differences, so far as they are tolerably constant and not merely accidental, are our safest guides to sanitary work. Taking the information as it stands for the year, we may gather from it the localities where vaccination of infants is incomplete, also those where drainage is not sufficient to counterbalance the effect of heavy rain, and the circles which in all probability are the most careless in the matter of cleansing. As a whole, the facts have an important bearing on the question of polluted village sites, and hence they show even now where work requires to be done for lessening the liability of the people to attacks of the whole epidemic tribe of diseases, and amongst them of small-pox which in an epidemic year escapes from the influence of vaccination alone, and occasions such results as we have described above. To complete the table and convert it into a sanitary picture of the whole provinces, it would be most useful, if found to be practicable, to give in two or three words the sanitary estimate of villages in each circle under "drainage," "water," "domestic cleansing," which would include what is wanted. To most people sanitary statistics alone do not afford sufficient information, notwithstanding the deplorable character of the facts in the present case which they set forth.

25. *Sanitary Works (Civil).*—This, which forms Section IX. of the Report, contains brief notes on the sanitary condition of municipal towns and districts, in reference to measures of improvement carried out in the course of the year. These notes refer to 83 localities, and are chiefly about surface drainage of the town sites, and in some cases on water-supply improvements, cleansing, filling up holes, &c. There is nothing in them specially calling for remark. But it may not be out of place by way of caution to call attention to the fact that the aggregate average town rate in 1884 was 42·47 per 1,000, while the average rate for the preceding five years was 39·35 per 1,000. Of the total rate of 1884, 2·18 per 1,000 was due to the small-pox epidemic. But deducting this latter rate the death ratios of 1884 were above the average.

26. Under the head of "*General Remarks*" Mr. Planck gives an account of his inspection and other work during the year, and as it is of importance to put on record any cases where work has been done, we may notice some of the reports briefly. We may first introduce the following general statement on this subject from the preceding Section IX.:—"During the year 1884 works of "sanitary improvement continued to be effected in almost every important centre of population, and "I have reason to think the increasing powers and the authority of the municipal and local authorities "is resulting in increased attention to and more effectual performance of those works so important to "the welfare of the people."

This is so far well, and allowance must be made for the recent origin of the authorities, and the new character of the works they have been called upon to perform.

27. As an example of an improving town, we may select Shahjehanpur, which has a population of 69,892, of which it is reported that "the open spaces of the town site are, as a rule, scrupulously "clean; tree shade abundant, a number of young trees recently planted along certain roads and in "certain market places. The houses of the main streets substantially built and comfortable "Thoroughfares metalled, drained, and lighted at night. Many of them lined with trees. They are "cleanly kept and in excellent repair. Town precincts fairly clean. Latrines, 41 in number, of "sheet-iron, on wooden frames, on small wheels run on rails, which border a trench on either side. "When the portion of the trench between the latrine has been sufficiently utilized, it is moved on "and the part filled with earth." These latrines, he says, "are beyond comparison the most satis-"factory of any existing in the province." The town site is surface drained to outfalls. "The "smaller town drains are flushed daily with water, collected from wells into masonry built tanks, "placed at the commencement of the drainage system in different places." The tank outflow is about the size of a gun barrel, and the result, he says, "is most satisfactory as regards purity of the "air of the towns." The final outfall is into rivers. "If this method of purifying the small drains "could be introduced into all cities and towns, it is absolutely certain that the existing unpleasant-"ness complained of in many of them would become a thing of the past." This may be true, but the public health might still suffer unless the whole domestic sewage were rigorously removed to a distance every day, and all cess-pits abolished. This measure is the real foundation of Indian sanitary improvement, to which all others are secondary. If a sensible nuisance alone is dealt with it is clear that real epidemic local causes which in most cases are not amenable to the senses, may be overlooked. The water-supply of Shahjehanpur is obtained from wells, and is reported "pure."

But the year's sanitary statistics appear to show some justification for this criticism as follows:—The district death-rate in 1884 was 34·62, against a previous five years' death-rate of 40·30 per 1,000, showing a reduction of about 6 per 1,000. Of the 1884 rate, 1·67 was due to cholera and 0·79 to small-pox. Let us now take Shahjehanpur town, the capital of the district, and we find that its five years' death-rate, which had been 33·61 per 1,000, was raised in 1884 to no less than 48·76 per 1,000, an excess of 15 per 1,000, and of the 1884 rate, 10·07 per 1,000 was due to cholera and 0·18 to small-pox. These facts show the need of statistical comparisons in judging of sanitary condition, and they also show that the sanitary condition of a town cannot be safely estimated from its mere surface appearances. The practical question suggested by the figures is simply this: Why was the death-rate from cholera in this town sixfold the rate of the district of which it is the capital? It would be consistent with past experience to anticipate the discovery of disease causes in and about the houses, and the subsoil on which they stand, potent enough to have localised cholera in the town to the excess shown by the statistics. In this case the dead are buried within the town limits.

28. *Lucknow* has a population of 239,773. Its sanitary improvements appear to be in a transition state. Part is well paved, and there are surface drains of an imperfect kind leading to stagnant nullahs. The chief object appears to have been the removal of surface water. After many centuries of occupation without drainage or proper cleansing, the whole subsoil has become polluted, so that the wells, with few exceptions, yield bad water, and the people have to obtain their supply outside town limits. "Surface cleanliness is well effected by a considerable company of public sweepers. A "great number of public latrines are in use, and are very carefully managed. As a rule, open "spaces between the houses are cleanly kept, but small bad smelling places may easily be found." Sewage "still stagnates in noisome ditches among the houses," and there is also a custom "of digging "pits in the site, for the attainment of earth required for building purposes, and afterwards filling "in the pits with sweepings, and the authorities even undertake to fill with sweepings any large "excavations which require levelling. As a result of all these sources of filthiness, the soil of "Lucknow site has become very impure." We shall next see what information the sanitary statistics afford as regarding the public health.

Lucknow district contains a population of 457,051. Its total death-rate in 1884 was 28·45 per 1,000, and its previous five years' average had been 31·24 per 1,000, so that the rate was improving. Lucknow town had a total death-rate of 40·96 per 1,000 in 1884, and a preceding five years' average of 43·89, so that the improving town is following the unimproving district at a considerable distance. The cholera mortality of the district was 0·26 and of the town 0·76 per 1,000, or threefold.

It is clear that the disease causes at Lucknow have not yet been reached by the existing sanitary procedure, and, if we might be allowed to make a suggestion, it would be that, as the case resembles similar cases in England, where much surface work had been done before the Public Health Act became law, with little effect, it would be advisable to have a thorough examination made of the whole area, and a consistent scheme prepared for ultimately improving the town, which, probably, would have to include, not only works of water-supply and drainage, but town improvements in streets, lanes, and houses.

29. *Mirzapur* city is another surface-clean town, of 85,362 inhabitants. "Tree shade is plentiful. ". . . . City has been much improved in recent years by the construction of an important "market-place. . . . Surface cleanliness fairly well effected, but collections of refuse were seen, "which could not be removed because about one-half of the conservancy carts are useless, being "out of repair. . . . . Several public latrines and urinals. . . . Surface drainage of the "public thoroughfares is effected by stone-made drains, into which the house drains open; therefore "sewage flows in them. . . . The drains are good, and the sewers apparently efficiently "constructed, but the outflow is almost nothing. It follows that, for a great portion of the year, the "impurities of all waste or refuse water remain in the city, and also much of solid impurity. . . . "Water-supply from wells, which are numerous and extremely fine." This town occupies what ought to be a healthy site, about 60 feet above the Ganges, and it is evident that work of a sanitary kind has been intended. But here we have the same result as in the Lucknow case, for Mirzapur district had a death-rate in 1884 of 27·54 per 1,000, and a previous five years' average of 28·41 per 1,000, while the town rate was 39·23 per 1,000, with a previous five years' average of 41·09.

30. We shall take one more case, the town of *Fyzabad*, which has a population of 38,828. It is stated that in this town "the main roads are wide, metalled, watered, and well lighted at night, "thoroughfares generally clean, town surrounded by carefully cultivated fields of potatoes, poppies, "or vegetables. Surface cleanliness satisfactory everywhere. In all, 32 public latrines are in use, "well built, and effectually managed on the dry-earth system." The sewage of these is sold to cultivators. There are the usual surface drains, which require improvement. "The sanitary condition "of Fyzabad is satisfactory," except the existing piecemeal system of drainage.

The statistical results to health stand as follow. Fyzabad district had a death-rate in 1884 of 25·67 per 1,000, and a previous five years' average of 28·74. Fyzabad town had a death-rate of 42·05 per 1,000 in 1884, and a previous five years' rate of 40·15 per 1,000. The cholera mortality of the town was nearly fourfold that of the district. In this same district is the town of Ajudhia, with a population of 14,643, which returned a death-rate in 1884 of no less than 88·80 per 1,000, against a preceding five years' rate of 87·35 per 1,000. Surely, if there ever was a case for removing the population or for an exhaustive inquiry and improvement, we have one here.

31. The practical result of these inspection reports, of which we have given a few as samples, is, of course, that mere surface work, whatever it may appear to the eye, is not only no test of real sanitary condition, but may be misleading, and they suggest that a competent sanitary engineer, to examine and advise improvements in these towns, as is now being done in Bombay, would be a very desirable addition to the sanitary organization of the provinces.

32. Appended to the Report of Mr. Planck are three reports of the Deputy Sanitary Commissioners of Circles, which contain a few points regarding the sanitary arrangements of their circles which may be noticed. The chief part of their work, besides supervising the vaccination service, was making sanitary inspections during their tours of duty, and advising the local authorities on the required improvements.

The general impression produced by their notes is the same as that which follows from the perusal of the Sanitary Commissioner's own Report, and this is that the need of sanitary improvement is being more and more recognized in the localities, that more work is being done, but that this is of a surface kind, leading to great visible change for the better in the outer aspect of many towns, but there are no facts adduced to show that the authorities have as yet gone deeper than the surface,

while there are facts presented by the death registration which show that wherever the death causes are, whether they be at the surface or in the subsoil itself, they have not yet been reached.

33. We shall first select a favourable example, in which the town is more healthy than the district. The Deputy Sanitary Commissioner informs us that "the city of *Meerut* still maintains its pre-"eminence in surface cleanliness and excellent conservancy arrangements." This benefit is attributed to the active personal exertions of the officials, who see that the work is done. The death-rate in Meerut in 1884 was 39·60 per 1,000, against a previous five years' rate of 35·83 per 1,000. But Meerut district rate was 43·82 per 1,000, with a previous five years' average of 46·08 per 1,000. The town has a population of 60,948, and good work had apparently been done, but it had the enormous fever death-rate of 32·63 per 1,000, and even this was below the district fever-rate, which was 41·69 per 1,000. The remedy required in this example, both for town and district, is drainage, and the facts show the need of discussing these local questions in presence of competent engineering officers. The object is, not to make a show of the facts, but to remove their causes.

34. Of *Agra* it is stated:—"The surface cleanliness of this large city everywhere satisfactory. "Good progress has been made in paving the principal streets with stone flags. This will effect "a great improvement, both in the appearance of the streets and in their sanitary condition. Street "drains, as a rule, dirty, in some cases blocked up with rubbish." There are numerous public latrines, but no dry earth used, "and the management is not satisfactory." The death-rate of Agra district in 1884 was 40·27 per 1,000, and during the previous five years it was 36·31 per 1,000; while the death-rate among 119,079 in Agra town in 1884 was 47·90, and this is a constant rate, as is shown by the previous five years' average, which was 47·54 per 1,000. Of this great rate 3·74 per 1,000 was due to cholera, against a corresponding rate of 0·68 per 1,000 for the district. The chief death cause, both in town and district, was fever.

35. One other illustration of a surface-clean town will be sufficient for our purpose.

Muttra.—This town has a population of 44,775. It is described as follows:—"Surface cleanliness "and drainage everywhere perfect. There is sufficient latrine accommodation of the open kind. ". . . They are kept fairly clean." Now, in 1884 the district death-rate of Muttra was 29·65 per 1,000, and its previous five years' rate 35·64 per 1,000. But Muttra town had the enormous rate of 83·30 per 1,000, with a previous five years' average of 49·22 per 1,000. To the great rate of 1884 cholera contributed 10·43 per 1,000, small-pox 3·28 per 1,000, and fever 42·66 per 1,000, while the district rate from cholera was 0·31, from small-pox 0·67, and from fever 25·93 per 1,000. Surely in this case we have an example of the effect of bad locality.

36. There is one other subject which requires notice, and this is the reappearance of mahamarri in Kumaun. We dealt with this disease formerly, and pointed out the means of prevention, and we shall give briefly the facts in the Report. The author, Dr. Richardson, says, from "personal "experience of typhus fever in Kumaun, I am perfectly satisfied that it is like typhus fever else-"where. Mahamarri is merely a malignant form of the disease. In whatever form it shows itself, "typhus fever is essentially one of the class of" filth "diseases."

It appears that the sanitary rules formerly issued for the prevention of mahamarri have been neglected, and that cattle are still housed under family sleeping-rooms, with a community of foul air between the room and the stable below the bed-room from floor openings. There is no room ventilation, and abundant filth. The excuse for housing cattle in houses in these hill districts is cold, but this is a separate question to be dealt with by itself, and can afford no excuse for the population being decimated by this most fatal, and, it may be added, this most easily preventible, form of typhus fever. We desire to draw special attention to this matter. In this case the cause of disease is well known; rules for its prevention were laid down many years ago with beneficial result; and now from relaxed observance of those rules the evil is beginning again to prevail.

In conclusion, this Sanitary Report, besides its value as a record of the year's facts and experience, has also a negative value, for it shows exactly where the work done during the year has failed up to a certain point; it has done good, no doubt, but, beyond this, it appears to have exerted little protective influence during an epidemic year. It follows that in large towns, where the subsoil has become dangerously polluted by long neglect, the people are living in a state of health which at any moment may give way under the first breath of an epidemic, and great loss of life may ensue. In the present case, the great small-pox epidemic ravaged the provinces in spite of the persistent efforts of the vaccination service, and it may be well once for all to recognize that what may be called "epidemicity"—a condition of these zymotic diseases which may show itself at any moment—is connected directly with the conditions under which the people live, and that, when it has once shown itself, the penalty of past sanitary neglect is certain to be exacted in spite of all palliative measures.

It will be learned from what has been said that only a very small number of population groups have been brought under municipal government, while the result of their work in the present Report shows that mere surface improvements may leave the real epidemic causes as active as ever. The Sanitary Commissioner of these provinces has done apparently all that careful inspection and reporting could do to expose the evils, but there has been an absence of the skilled sanitary engineering element to examine and point out the required works and measures. And besides this, the real epidemic problems do not lie within the circles of a hundred towns or so, but they are to be found among the 105,421 villages in which the people spend their lives.

The Government of India has pointed out the real administrative defects in the present procedure in the following passage in their letter on this Report. They say, "No important steps appear to "have been taken to improve the sanitary condition of the villages in any district. The Lieutenant "Governor has, however, desired district officers to endeavour to induce villagers to adopt some "simple rules of sanitation. In towns with few exceptions no sanitary work of any magnitude "was executed during the year, the expenditure in most instances having been directed towards the "maintenance or improvement of existing arrangements in connection with drainage or water-supply, "and in some cases to small original works, such as sinking of wells, construction of masonry drains, "culverts, latrines, &c."

We have only to add that the village population, which forms the subject of the first paragraph of this extract, amounts to 41,358,922, and the town population to 2,748,947. The simple figures show the immensity and difficulties of the problems to be solved. But, unfortunately these epidemic outbreaks do not wait for solutions. They follow the law of their existence, and so long as resting places are left for them, they will be certain to find them.

16th March 1886.

No. 7.

Memorandum of the Army Sanitary Commission on the Report of the Sanitary Commissioner of the Central Provinces for 1884.

1. The census population of these provinces in 1881 was returned at 8,817,185, and this number is used in the present Report for calculating the ratios. In a former Memorandum we took exception to this part of the Report on account of certain anomalous results presented by the ratios of successive years, and as our remarks have been referred to by the Sanitary Commissioner, we shall quote what he says on the subject:—

"In their Memorandum of the Report of the Sanitary Commissioner of the Central Provinces for "1882, the Army Sanitary Commission made the following remarks:—'In the ten years' interval "'1872 to 1881, it does not appear that any annual estimate of the population was used in calcu-"'lating the ratios, and hence it would scarcely be worth the trouble to compare the death-rates of "'1882 with those of preceding years, were it not that no other data are available.'

"The Commission would thus seem to hint that an annual estimate of the population on which to "calculate the ratios should be made as is done in England. But I believe from an examination of "the reports that no such calculation is made by the Sanitary Commissioners with the Government "of India or other Sanitary Commissioners in this country; and the experience of the year 1884 "with its comparatively large birth and small death rate, and the frequent recurrence of cholera "epidemics, appear to me to show how difficult it would be to fix any such estimate for the Central "Provinces."

2. We agree with what is here said about the difficulty of forming an annual estimate of population, especially in a country where registration of births and deaths has been recently introduced. What we are concerned with is that those charged with sanitary work and the expenditure of money upon it should have the means of estimating the effect produced annually, at least, by the outlay.

3. Methods of estimating increase of population over so large an area as India would probably vary, and movements of population would have to be taken into account, and of these the Central Provinces have afforded some notable examples, but, nevertheless, a careful analysis of the vital statistics of past years would enable an approximate value to be given to annual increase, subject of course to corrections until the normal law of increase was ascertained. As the matter stands at present we have the birth and death rates calculated on the first year of each decennial census period, and as this is done for all the districts, the ratios are unreliable and admit of no approximate annual or district comparisons. It is different, of course, with the actual numbers of births and deaths, which in the present state of the registration afford the most reliable means of estimating the state of the public health in localities and years. With these remarks we must leave the question in the hands of the authorities, who are fully aware of the importance of vital statistics to sanitary administration and progress.

4. The births registered in the Central Provinces in 1884 numbered 368,086, or 41·75 per 1,000 of the population. Compared with the numbers in 1881, the census year, which were 362,744, there was an increase in 1884 of 5,342 births, or ·54 per 1,000, both ratios being calculated on the population of 1881. Of the births in 1884 there were 190,702 of males and 177,384 of females.

The birth-rate is apparently too high from defect in the population element, but the numbers show good registration work. There was also a nearer approach to uniformity in the birth registration of the districts, which ranged between 33·37 and 51·21 per 1,000, but this latter ratio and several other district ratios go to show that the population element used was too low.

5. The deaths registered were of males 128,365, and of females 112,349, together 240,714, or 27·30 per 1,000 of the population of 1881. In 1881 the death-rate was 27·43 per 1,000. The lowest district rate registered in 1884 was 22·13 per 1,000 at Sambalpur, and the highest 32·70 was returned from Damoh. Generally the death registration is increasing in efficiency.

6. The death causes were as follow:—

Diseases.	Total Deaths.	Deaths per 1,000.
Cholera	142	0·02
Small-pox	4,882	0·55
Fever	145,342	16·48
Bowel complaints	21,991	2·49
Injuries	4,446	0·51
Other causes	63,904	7·25
All causes	240,714	27·30

7. The first remark suggested by this table is the very low death-rate from cholera. It was the next lowest on record, but this fact only shows that 1884 was a year of cholera quiescence in these provinces, and that it was part of the usual cholera history, which, for the last 11 years, has stood as follows:—

Years.	Deaths from Cholera.	Years.	Deaths from Cholera.
1874	14	1880	330
1875	24,643	1881	9,140
1876	20,124	1882	11,932
1877	3,418	1883	16,235
1878	40,985	1884	142
1879	27,575		

Nothing can be predicated from the low rate of 1884, except that it affords no evidence that less vigilance in dealing with local causes is required than has been necessary heretofore. Next year's death-rate may be that of an epidemic, instead of being due to a few sporadic outbreaks, as it was in the year 1884. Deaths were returned from no more than 14 registration circles out of 168. There are 27,647 villages in the provinces, all of which escaped except 40. There are 73 towns, six of which yielded 18 deaths, equal to a rate of ·02 of the town population, and the village death-rate was exactly the same.

8. The monthly incidence of the disease was as follows:—

Months. 1884.	Cholera Deaths.	Months. 1884.	Cholera Deaths.
January	—	July	1
February	—	August	—
March	52	September	12
April	16	October	28
May	17	November	17
June	5	December	1

Cholera was most prevalent in Nimar district, where four circles out of six, and 23 villages out of 470, yielded 84 deaths, or ·55 per 1,000 of the district population. The town which suffered most was Narsingpur, where, out of 10,222 people, five died of cholera, or ·49 per 1,000.

9. The Report contains no sanitary information about attacked localities. We are told that "the "outbreaks in Jubbulpore, Narsinghpur, Nimar, and Chanda are fully reported on by the Civil "Surgeons," but none of the reports are given either entire or in abstract. This is to be regretted, because amongst other results it breaks the continuity of cholera history, not only in the provinces as a whole, but in such cases as the appearance of cholera at Birman fair, a matter of very considerable importance. Not much can be learned from such a note as the following about Nimar, where the cholera was prevalent:—"Many marriage parties were moving about the country, and the "sanitary state of several of the villages in which persons were attacked is reported to have been "very bad."

10. *Small-pox.*—Information about small-pox is as deficient as that about cholera. It is statistical without giving conditions, while these last are daily becoming of more importance all over India, for the numbers of the vaccinated population increase without any corresponding decrease of mortality.

11. The following have been the registered small-pox deaths for the last five years:—

Years.	Small-pox Deaths.
1880	5,184
1881	1,816
1882	3,945
1883	4,696
1884	4,882
Total deaths	20,523

During the same five years there were 1,684,372 persons vaccinated. The successful vaccinations averaged 180·78 per 1,000 of the population, and the small-pox deaths 2·33 per 1,000, clearly showing that the remedy did not cover all the conditions of the disease. The above abstract indeed points to the progress of an epidemic in face of the vaccination. The maximum death-rate of the five years was returned from Nimar district. It reached a total of 5·45 per 1,000, and this district returned the highest vaccination ratio for the period of all the districts, namely, 245·16 per 1,000.

12. Small-pox deaths were returned in 1884 from 133 out of 168 registration circles, and from 2,001 villages out of 27,674. Every month yielded deaths, as the following abstract shows:—

Months.	Small-pox Deaths.	Months.	Small-pox Deaths.
January	253	July	688
February	277	August	337
March	363	September	192
April	548	October	110
May	799	November	169
June	806	December	335

The towns, of which 42 were attacked, yielded 604 deaths, or ·80 per 1,000. The district rate was ·55 per 1,000.

13. The relation of small-pox mortality to vaccination may be approximately arrived at by the following comparisons. During five years ending 1884, the annual vaccinations averaged 336,874 per annum. The births in 1884 were 368,086, hence the vaccinations at all ages did not fall very far short of the births. The present Report does not give the ages of the vaccinated, but it gives the ages of deaths from small-pox as follows:—

Total deaths from small-pox	4,882
,, ,, under 1 year	1,968
,, ,, under 12 years	2,278

It follows that 40 per cent. of the small-pox mortality of 1884 took place in children under one year of age, a result which appears to show that too small a proportion of the children born was vaccinated within the year.

The actual numbers vaccinated in the Central Provinces has been so considerable that we may safely introduce the following yearly ratio of small-pox mortality as affording an estimate of the results to health:—

Years.	Small-pox Deaths per 1,000.	Years.	Small-pox Deaths per 1,000.
1870	·30	1878	2·18
1871	·20	1879	3·44
1872	·57	1880	·69
1873	1·37	1881	·21
1874	2·38	1882	·45
1875	2·78	1883	·53
1876	·51	1884	·55
1877	·37		

These figures appear to show what may be called a current death-rate from small-pox, into which periods of considerable epidemic increase are intercalated, but there has been no such increase during the last five years, although it can scarcely be said that the figures show steady decline in the mortality.

The whole experience may be summed up as follows:—A much larger proportion of children under one year of age should be vaccinated, because 40 per cent. of the mortality takes place under that age. The disease is liable to take on the epidemic character in these provinces as elsewhere, and this characteristic of the disease must be met by sanitary work.

14. *Fevers.*—There were registered 145,342 deaths from fever, a ratio of 16·48 per 1,000 of the population. The preceding five years' average rate had been 18·68 per 1,000. The disease, though less fatal, was generally diffused over the provinces. All the registration circles, 168 in number, returned fever deaths, and out of 27,674 villages 21,451 suffered. The fever type was of the ordinary intermittent form.

15. The following was the monthly mortality :—

Months.	Fever Deaths.	Months.	Fever Deaths.
January	11,271	July	8,859
February	9,655	August	12,289
March	10,918	September	15,858
April	11,342	October	15,254
May	11,694	November	13,199
June	10,855	December	12,646

All the 73 towns returned fever deaths, numbering in all 7,880, or 10·41 per 1,000 of the town population, while the rural rate was 17·05 per 1,000. The lowest district fever rate was that of Nagpur, 6·66 per 1,000. The highest, 25·28 per 1,000, was returned from Narsinghpur. The fever death-rate of Nagpur town was 3·41 per 1,000 out of its large population of 98,299. This was one of the towns which escaped cholera. The highest town rate of the year was returned from the small town of Mohari, where out of 5,142 people 164 died of fever, or above 3 per cent. of the population. But in the present state of fever diagnosis not much reliance can be placed on the figures; it may, however, be safely stated that there is some error in attributing so large a loss of life to intermittent fever.

16. The only remark bearing on the predisposing causes of these fevers is as follows:—"I think "that the low death-rate from fever is not what would (judging from the remarks in former sanitary "reports) have been anticipated considering the heavy rainfall that prevailed in the provinces" (to wit, 67·4 inches, against a previous 18 years' average of 49·83 inches). But the absolute quantity of rain is of less importance in such inquiries than its distribution in time and locality, and the officiating secretary to the Chief Commissioner states that the rainfall was above the average in the rainy months (July to October), and below the average in the hot weather months (March to June), hence the drying up was more limited in duration, and changes in temperature somewhat less severe.

Not much help can be got from this discussion as it stands, because a reference to the monthly mortality table shows that the registered deaths did not fall greatly in number after the rains; all that really can be said is that if the rains had ceased sooner the fever deaths might have been more numerous. No more need be said on the question of climate, because taken by itself it scarcely aids our work, while on all the other causes of fever there is a total blank in this Report. As part of the fever history of these provinces we may quote from the Acting Secretary's letter the following fever rates during the last ten years :—

Years.	Fever Deaths per 1,000.	Years.	Fever Deaths per 1000.
1875	16·28	1880	18·46
1876	20·22	1881	19·42
1877	17·70	1882	17·31
1878	29·50	1883	49·86
1879	18·34	1884	16·48

These figures show that with high annual rates the first and last years in the series exhibited exceptionally low rates, but this is all we can deduce from them.

17. *Bowel complaints.*—Under this head, which includes deaths from dysentery and diarrhœa, there were registered 21,991 deaths, or 2·49 per 1,000 of the population. Every one of the 168 circles of registration returned bowel complaint deaths, and 7,655 villages out of 27,674 did so.

18. Bowel complaints and cholera are about the best known diseases among the Native population, and considering the great disproportion between the mortality of these diseases in the returns, it is of interest to give the following monthly contrast for the year :—

Months.	Registered Deaths from Bowel Complaints.	Registered Deaths from Cholera.
January	1,478	—
February	1,155	—
March	1,380	53
April	1,653	16
May	1,653	17
June	1,471	5
July	1,485	1
August	2,465	—
September	3,905	12
October	2,421	28
November	2,112	17
December	1,813	1

It is evident that the data refer to two distinct diseases or more. Cholera apparently had to wait for the month of March before it could find a footing, and then it burst out with the largest monthly mortality of the year. So far as these diseases are related to local predisposing causes it is evident

that bowel complaints are more influenced by them than cholera. This is all that can be said, for the Report contains no information on epidemic death causes except what may be inferred from the details under the head of sanitary works.

19. *Injuries.*—Under this head were registered 293 suicides of males and 295 of females. There were 2,833 deaths from wounding and accident, 1,019 from snake-bite and wild beasts, in all 4,446 violent deaths.

20. *All other causes* included 63,904 registered deaths, of which nothing besides the number is known.

21. (*Sanitary Works Civil*). There are returns of income and expenditure given for 19 head-quarter towns, from which it appears that their total income is about 63,000*l.*, which was expended on public health work in very various proportions. Including medical relief, the lowest percentage of income so spent was 11·76 in Bilaspur, the highest 74·60 in Balaghat. Generally, the largest proportion was devoted to conservancy. In the course of the year 144 new wells were dug and seven were repaired. These numbers are exclusive of the usual repairing work. A new pumping engine was put up for water-supply in Nimar. In Balaghat four swamps were drained. These, with the drainage of some land close to the town of Bhandara and the construction of a few latrines and dust bins, were the chief works of the year. The annual death-rate taken over the 73 towns was 25·37 per 1,000, against a previous five years' rate of 35·40, but the lower rate was mainly due to the absence of cholera, from which only 18 deaths took place in all the towns.

22. *General remarks.*—Section X., which gives some account of the sanitary proceedings of the year, is by far the most important part of the Sanitary Commissioner's Report, for it shows that a considerable number of simple but efficient improvements were in progress. He personally inspected 18 of the towns and a considerable number of villages, with the object of estimating their present sanitary condition and the progress made in applying legal provisions to the removal of disease causes. Brief abstracts are also given of inspection reports made by Civil Surgeons.

23. The details need not be given in full, but the following brief abstract will show the general nature of them:—"In all the towns a large amount of attention is paid to sanitation. . . . In "all but Balaghat and Badnur, which are really villages, public latrines exist, and the dry-earth "conservancy system is in force."

24. On the subject of *drainage* the information is not so satisfactory.

Of *Bhandara* we are told that the drainage is defective; the outlet is a natural one, liable to being silted up, and pools remain after the rains. "Shallow tanks exist on the outskirts of the town, and "pits caused by the digging of clay for making brick and tiles, the brickmakers being allowed to dig "it where they please." This is a common disease cause all over India. It should be put an end to, and the holes filled up. An instance is mentioned in the Bengal Report of the present year 1884, in which clay is taken, not from pits, but from the surface. Anyway, pit digging is most unsafe near any town or village.

At *Seoni* a contrary proceeding is taking place, for we are told that "very good work has been "done in the way of filling up some hollows and draining others." Now, either the digging of holes or the filling up must be immaterial to health. It should be decided which practice is to be followed by the municipalities and village authorities, and if digging is to be prevented, as beyond all doubt it ought to be, it should be done. In the present case drainage is being steadily improved by shallow surface drains. At Hinganhat the drains are badly constructed and much covered up by boards or masonry. No drains exist except along the main roads.

At *Nagpur* the drainage is "defective. There are a large number of more or less deep excava-"tions scattered through all the inhabited site, in a large part of which no drains exist." Nagpur was one of the first towns which brought in a water-supply, and the expense of this work has not yet been cleared off. The municipality is thus hampered from want of funds, but, unfortunately, water cannot be had without drainage to carry the used water away except at a great risk to health. Nevertheless, the statistics show improving health. The rate from all causes in 1884 was 23·95 per 1,000, against a previous five years' mortality of 30·15 per 1,000. It had no cholera, and the fever deaths were 3·41 per 1,000. Besides the current conservancy work, Nagpur will derive most benefit by extending the water-supply over the town, by abolishing all bad and doubtful wells, and by adopting a system of drainage suitable to the locality.

Of *Warora*, it is said that its drainage, "except that of the chief bazaar, is very bad." The town stands in almost a swamp in the rains.

A similar remark is made about the drainage of *Chanda*.

Jubbulpore, where the conservancy is well carried out, has defective drainage. "A large part of "the city has no drains, while there are hollows and excavations which it would be well to fill up, if "possible."

These instances appear to be sufficient to show the nature of the present defects, which the Sanitary Commissioner sums up under the expression "that the drainage of most towns is unsatisfactory." And he suggests that the first thing to do is to have a series of levels taken all over the towns, and then shallow drains constructed on these levels, instead of the present deep drains, which are receptacles of rubbish, and very often without a proper fall, from having been constructed piece-meal. This would appear to be the proper course to follow, but it must be borne in mind that no system of surface drains, however well laid, can obviate the necessity of very frequent washing out by special provision of water, in the way already in use in a number of towns in the north of India, where water is raised from wells into tanks at the higher ends of the drains, whence it is discharged into those to wash their contents to the outlet. In this way nuisance and unwholesome emanations are prevented.

25. *Water-supply.*—We have already noticed the increase of wells, and a few points may be introduced from the digests. The water-supply of *Bhandara* is almost entirely from wells. Many of the town wells are brackish, while those outside the town are good, marking, apparently, sewage pollution of the town wells.

The *Seoni* wells are also brackish, but the domestic water-supply is mostly drawn from a filtered tank supply, which is, of course, a great improvement; but the water, in place of being properly distributed, is drawn from the reservoir, "into which all kinds of vessels and ropes, clean and dirty, "are dipped, and into which all kinds of impurities must be blown by the winds." This practice is altogether contrary to the true principles of water distribution, which render it imperative that the water should reach the consumers as pure as it is at its source. What is wanted in the present case is the delivery of the filtered water into a closed tank, sufficiently raised to admit of water being drawn from it by water taps.

The wells at *Narsinghpur Kandela* are mostly out of repair, and yield brackish water, an almost certain proof of sewage reaching the wells.

A similar condition of the water-supply exists at *Chindwara*. The best wells are those supplied by infiltration from a tank, one of the methods of obtaining better water proposed in our "Suggestions."

Hinganghat derives its water-supply for the new town by pipes from the river.

At *Nagpur* the water-supply from the Ambajhorri lake "is being steadily extended," but is still incompletely distributed.

For some cause not stated the town of *Chanda* is being "steadily deserted." Much of the site has become overgrown with jungle, and the people are settling in villages. The well water is brackish and impure. *Jubbulpore* has a water-supply conducted into the town, and this is largely distributed by standards.

The water-supply of *Damoh* is derived from a gathering ground and receiving tank. The water is coloured, and should be filtered before distribution.

Raipur has its water-supply largely from tanks. "The purity of the water appears very doubtful." This is one of the largest towns in the Central Provinces, and contains 24,948 inhabitants. Its five years' annual death-rate had been 34·38 per 1,000, and in 1884, in the total absence of cholera, it was 32·75 per 1,000. The suspicious water was there, but not the cholera. But of the 1884 death-rate no less than 24·21 per 1,000 was due to "fevers." In this case the tank water should be examined, and steps taken by filtration and protection to improve the water.

Defects in the water-supply of *Burhanpur* are described as follows:—"Water-supply is from the "spring, some three miles off. The water from this has not been laid on to all parts of the town. "The system of building reservoirs instead of or in addition to standards appears bad, as the water "in them is open to pollution from many sources." Proceedings such as these are contrary to the first principles of water distribution, which, as we have already stated, require that the supply should be delivered for consumption as pure as it leaves the source. In such cases as this open tanks should not be constructed within town areas, and tanks in towns are only of use as distributing centres from which water is to be taken, never by indiscriminate drawing, but from water taps let into the tank.

Khandwa appears to be supplied with water by pipes from a bunded nullah, which derives its supply in turn from a catchment area "not attended to as it should be." The supply of this town is still undecided, and under consideration for extension.

26. There appears to be no example in these provinces of the application of liquid sewage to agriculture, for there is no house drainage. Removal of all filth and refuse matters by hand labour is more or less practised, together with trenching and cultivating the trenched area. This, if carefully supervised, is the next best method after sewage irrigation, but it requires care and continual oversight to prevent fouling of surfaces and pollution of subsoil water sources.

27. It is satisfactory to learn that a commencement has been made in the sanitation of part of the 27,674 villages in the provinces. What has been already stated refers only to sanitary work in a few towns, but as the real epidemic disease causes are found in villages and their vicinity, it is clear that until these disease centres are dealt with the public health can never be safe. The method in use for dealing with village problems has been to draw up and circulate sanitary rules, which, besides being of the nature of positive enactments, contain a certain amount of instructional matter to enable the local village officials to understand what is required of them. The rules include removal of all house refuse matter outside the area; filling up of holes and providing rain-water drains to be periodically cleared out; the use of house refuse after removal and keeping for manure; providing latrines, and prevention of personal nuisances within 200 yards of the boundary; rooting up useless bushes, high grass, &c., within 100 yards of the boundary; providing properly constructed wells, and protecting the outskirts of water-supply sources along rivers from pollution; burying of carcases of animals not nearer than 300 yards to leeward of villages; burning or burial of human remains to be carried out at a distance; cautions against using foul village tanks as water sources, and proposing wells sunk near them as safer sources.

28. All these prescriptions are good, and, if obeyed continuously, will no doubt remove many disease causes. But they contain no provision for doing away with the great Indian village evil of stalling cattle in houses or house compounds. Just as it may be possible to supply a whole village except the low castes with water from a single deep well, so it might be possible to plan some kind of arrangement whereby the village cattle might be sheltered and protected within the boundary, instead of risking the health and life of so many people as is entailed by the existing practice.

The present arrangements are very properly designated by the Sanitary Commissioner as "a very "insanitary practice, especially as these cattle sheds are usually in a most foul condition, and is one

"that it is most desirable to put a stop to." Anyway a beginning has been made, and we have a few statements by the Sanitary Commissioner to show how the rules have been applied, this inspection and report being part of the procedure.

Of the *Saugor* district he says,—"Much attention is given to the sanitation of the head-quarter "towns or tahsils, and to that of villages, the result being that in it I found the rules regarding the "depositing of refuse outside the villages, and the using of a selected site as a latrine more generally "carried out than in any of the other districts through which I passed." But in most of the villages these rules appear not to have been carried out.

The rules in regard to burial were "more or less in force."

Improved water-supply is said to be "fairly well carried out," or "not unfrequently followed for "the supply of the upper classes."

We are glad to learn that in *Nimar* the Civil Surgeon has given much attention to the providing wells for the lower castes, "a very good sanitary work."

29. The abstract of inspection works by Civil Surgeons contains information similar to that already given, and no remark is called for.

30. *Fairs.*—We have already noticed the appearance of cholera at Birman fair, held in Narsinghpur district. The district had in all 11 deaths from cholera in four villages out of 336.

Birman fair was held between the 13th and 22nd November, and 35,000 people were present on the great bathing day. There were five cases among pilgrims at the fair, and eight were attacked after leaving it. There were four deaths.

Ramtek fair was attended by about 234,000 people, and there was no cholera. The usual sanitary work was done in both cases.

31. In conclusion, instead of making any general remarks of our own on this year's Report, we prefer to give the following summing up by the Chief Commissioner, with which we would express our general concurrence. He says he "is quite aware that much has been done in improving the "sanitation of towns and villages. He has insisted, when necessary, on municipal committees doing "their duty in this matter, and he will not permit this duty to be neglected. But he also realizes "that much good work has been done, and he is convinced that to have such work carefully "ascertained and acknowledged does much to encourage those who are engaged in it. In regard to "village sanitation energy must be accompanied with patience, but greater progress may no doubt "be looked for now that we have responsible mukaddams in every village, and that the agency of "local boards can be made use of." We would only add that the true test of sanitary progress in the Central Provinces, as elsewhere in India, is to be found only in the gradual decline of mortality from epidemic diseases. And whenever in any locality the epidemic deaths have been more numerous than usual there, the sanitary executive should be at once called to account.

15th June 1886.

No. 8.

Memorandum of the Army Sanitary Commission on the Report of the Sanitary Commissioner for the Hyderabad Assigned Districts for 1884.

1. The population adopted in the present Report is that of the census of 1881, namely 2,630,018. In 1884 the births registered were of males 56,143, and of females 52,582, making a total of 108,725, or 41·3 per 1,000 of the census population. The registration appears to be improving in this datum, for the lowest rate registered was 37 per 1,000 in Wun district, and the highest 45 per 1,000 in Buldana, but some correction for increase of population appears to be required. The ratio of male to female births was 106·8 to 100.

2. The registered deaths were—

Of males	33,899	
Of females	30,909	
Together	64,808,	or 24·6 per 1,000.

For every 100 deaths of females there died 109·7 males.

As compared with the previous five years' death rates, the mean rates for these years were 29·8 for both sexes, showing a reduction in the death rate of 1884 of 5·2 per 1000. This reduction extended to all the six districts of the province.

3. The assigned death causes in 1884 were as follow:—

Diseases.	Total Deaths.	Deaths per 1,000 of Population.
Cholera	87	·03
Small-pox	615	·2
Fevers	30,551	11·6
Bowel complaints	9,319	3·5
Injuries	959	·4
All other causes	23,377	8·9
Total	64,808	24·63

It will be seen from this abstract that the causes of death of about a third of the mortality were not registered; that cholera was the least fatal epidemic, and diseases classed as fevers the most fatal death causes of the year.

4. The cholera history in these districts presents features of great interest, from the immense variations in mortality which it presents in successive years. Who could have anticipated, for example, that these 87 deaths in 1884 had been preceded in 1883 by a loss of 27,897 deaths from cholera? The sequence was, however, only an example of what usually takes place, as may be seen in the following abstract of cholera mortality for a series of 17 years, beginning with 1868, in which year cholera yielded 5,447 deaths.

The mortality in subsequent years of the series was as follows:—

Years.	Deaths from Cholera.	Years.	Deaths from Cholera.
1869	10,947	1877	842
1870	504	1878	34,806
1871	581	1879	223
1872	1,578	1880	1
1873	—	1881	5,404
1874	2	1882	3,576
1875	22,465	1883	27,897
1876	2,683	1884	87

The average mortality for the first 16 years was 7,152 deaths, represented by 87 deaths in 1884.

5. The cholera of 1884 had none of the usual features of an epidemic. There was an outbreak in Buldana district in May, during which there were 5 deaths; the same district yielded 8 deaths in September, 25 in October, and 13 in November. These deaths, together with 6 in Ellichpur district in September and 30 in Akola in November, made up the year's mortality, which stood as follows by months:—

	Deaths.
May	5
September	14
October	25
November	43
Total	87

6. There are 143 registration circles, 10 of which yielded cholera deaths. Eleven towns, with a population of 15,177, returned 11 deaths, or 0·6 per 1,000 on the town populations, but 10 of the deaths were registered in one town, Malkapur, with 8,152 inhabitants, a death-rate of 1·2 per 1,000. The remaining 76 deaths were returned from the six districts, giving a death-rate of ·03 on their entire population of 2,491,640. But this population is distributed among 5,501 villages, only 19 of which were, however, affected. The deaths hence averaged 4 per attacked village.

7. Taking the past cholera district as a whole, it has presented phenomena of which no explanation has yet been given. The case as against any single cause for them as regards the experience of 1884 is put by the Sanitary Commissioner as follows, and we quote it here in order that it may be duly weighed elsewhere:—"These variations in the intensity of cholera outbreaks from year to year occur "everywhere in India, ... and would indicate that something beyond the cholera bacillus "contaminated water supply, or human intercourse is necessary to explain this difference between the "results of different years. If any of these theories regarding the cause and spread of cholera be "true, how came it that cholera did not spread from these 19 centres by the diffusion of the cholera "in some one of these ways, instead of remaining localized in the manner it did?"

After showing that similar defects prevail in all other attempts at explanation, he continues:—"Whatever these conditions or influences may be which originate and favour the spread of cholera, "they still remain to be discovered, or the cause explained why one season should be healthy and "another unhealthy."

8. But the case is different when practical measures of mitigation or prevention have to be considered, and he says on this all-important aspect of the question, "We know, however, that much "can be done beforehand to ward off the ravages of cholera when it does come by attention to the "sanitary condition of our towns and villages, for experience has shown that as dirt invites and "fosters cholera, so on the other hand a good sanitary state greatly lessens the liability to attack."

This is about all that can be said in the present state of our knowledge. All the facts point to epidemic intensity as being the factor which determines the extent of prevalence and tendency to attack in any given season, but the actual severity and mortality of cholera is very materially influenced by the conditions of life of the people. And it so happens that these conditions are greatly under our control, yet they are the very elements of the question, which are liable to be overlooked or ignored when attempts are made to simplify or systematize our knowledge of cholera by assigning its manifold phenomena to a single hypothetical cause.

9. Recent European experience has afforded abundant evidence of this result, more especially in the case of Spain, where one of the most fatal cholera epidemics on record has been connected with very obvious neglect of the simplest sanitary laws, and where immunity from the consequences was fruitlessly sought primarily in quarantine, and then, when quarantine had failed, by inoculating some 50,000 people with a preparation of the so-called cholera bacillus. The real result of the proceedings having been to confirm the views of those who held the non-contagious nature of cholera, and not to obtain immunity from attacks of cholera by restrictions on intercourse, or by submitting to the operation.

10. In a previous abstract we have shown the extraordinary variation in the cholera mortality of different years, and the following analysis shows the aggregate monthly cholera deaths for 10 years, 1875 to 1884, to which we have added the mean temperatures and mean rainfalls for the same months:—

Months.	Aggregate Monthly Deaths from Cholera, 1875 to 1884.	Means of Ten Years, 1875 to 1884.	
		Mean Temperature.	Mean Rainfall.
		°	Inches.
January	63	67·1	·37
February	2	75·4	·18
March	29	83·9	·23
April	137	87·3	·15
May	2,796	93·0	·48
June	11,892	86·0	6·46
July	31,072	79·6	8·62
August	32,984	79·0	7·35
September	9,918	78·8	7·76
October	2,368	76·2	2·39
November	801	71·2	·43
December	819	67·6	·84

The first result of this table is to show the extraordinary difference in the cholera death-rates of different months. May is the month of epidemic increase, August is the month of maximum mortality, and the mortality of the four months, June to September, was about 13-fold the mortality of the other eight months. But the really erratic nature of cholera in these provinces is shown by the annual monthly data. Thus, in January, the 63 deaths took place in five years, while five years escaped. In February the two deaths registered were in two years out of ten. In March all the 29 deaths were due to one year. In April three years suffered and seven years escaped. In May, when the epidemic began to increase in severity, seven years yielded deaths and three years none. The June increase took place in eight years, and in two there was no cholera, but in other two years there were only two deaths. In July and August, when the epidemic loss was greatest, one year only escaped loss in the former month and two in the latter. September, October, and November escaped deaths each during two years of the ten, and in December four years had no deaths.

11. On comparing the column of mortality with those of climate, it appears to be proved that low temperature is accompanied by decline of cholera, and that the great increase during the middle of the year is preceded and accompanied by increased heat and by increase of rain, which last, however, is followed by reduction in mortality, while the low fall of rain in the first five months is followed by the annual epidemic outburst. It is impossible to say whether these events are merely coincident, or whether they stand in the relation of effects and causes. Of the remarkable character of the facts themselves there can be no doubt, although they do not help us to account for the equally remarkable variations in cholera mortality which take place in successive years. There seems to be at present some missing link in the facts, but we must admit that the intensity and fatality of cholera in these provinces year by year is itself a fact in the epidemic history marking what may be called variation in epidemic intensity. It was at one time supposed to indicate that during the severe epidemic years so many susceptible people died that there were fewer left to yield next year's deaths, but the tables of which we have given abstracts do not confirm this view, and we must for the present turn our attention to the practical aspects of the question.

12. We have already stated generally the year's distribution of cholera, and the next table shows how the intensity of the disease varied in each district during two years, 1883 and 1884, as this is shown by the number of villages attacked, and the deaths in each.

Districts.	Total Number of Villages.		Number of Villages affected.		Average Number of Deaths in each affected Village.	
	1883.	1884.	1883.	1884.	1883.	1884.
Amraoti	1,047	1,047	408	—	15·5	—
Ellichpur	474	477	265	4	19·4	1·5
Wun	1,260	1,192	251	—	11·4	—
Basim	945	945	305	—	15·6	—
Akola	964	964	278	5	15·5	6·4
Buldana	874	876	286	10	19·4	5·1
Total	5,564	5,501	1,838	19	15·2	4

To complete the means of comparison which this table affords, we may repeat that the total deaths from cholera in 1883 were 27,897, and in 1884 they were 87. Nothing could more clearly show how little real knowledge we as yet possess of the determining causes of cholera epidemics. We have no reason to suppose that local, personal, or climatic conditions had undergone any change, or that human intercourse between the population groups was any way different during these two years, or that the most rigid quarantine precautions would have made the smallest difference in the mortality. The simple facts lead us to a different conclusion altogether, and this is that cholera comes and goes sometimes pressing lightly, sometimes heavily on the population in its passage, and we shall next see under what conditions it presented itself among the population groups which suffered.

13. In the preceding table it will be seen that cholera was most intense in Buldana district in 1884, and that out of 876 villages 10 yielded cholera deaths at a rate of 5·1 deaths per village. It was in the village of Bhalegaon in Mulkapur circle of this district that the first case of cholera in 1884 was reported. A mahar employed on the railway was seized, and died on the 3rd May in 12 hours of bowel complaint, but there is little doubt that the cause of death was cholera. "On the "next day a Hindu lad, who had no communication in any way with the mahar, was taken ill "in the same way, and died in 12 hours." There is said to have been no suppression of urine in "either case.

Two similar cases took place on 18th May, one of which died. On the 19th there were four cases, and one died. Up to the 28th May, when the Civil Surgeon visited the locality, there had been 11 cases, exclusive of the first two, and he continues:—"Whichever be taken as the first case the "disease was plainly indigenous. The disease was not anywhere in the district, and there had "decidedly been no communication with any infected place out of the district." The village consisted of 100 huts and a population of 508. The Medical Officer who visited the locality could detect no local cause for the outbreak. Excluding the first doubtful cases, there were 3 deaths out of 11 attacks. There was no more cholera in the district for three months, but on the 23rd September the disease appeared in the village of Makori, situated some 10 miles to the south of Bhalegaon. In this second locality there were 20 attacks and 6 deaths. The village consists of 275 huts, and the population numbered 1,300. There was no cholera in the district at the time, and no communication could be traced with any affected locality. The first case was in a child which in the forenoon partook of its usual food. At 4 p.m. it was seized with vomiting and purging. At about 11 p.m. it died.

This village differed considerably in its external sanitary appearance from the village first attacked. The locality is damp, the drainage defective; the house floors damp, and cattle were stalled within the village. The water was obtained from 35 wells, and appeared to be good. "The first case was "undoubtedly indigenous, and the disease was not confined to one spot in the village. Shortly after "the appearance of cholera in this village it broke out in five other villages in Malkapur circle, "none of them neighbouring villages to Makori." In all 12 towns and villages were attacked out of 201 in the affected circles. There were 149 attacks and 51 deaths.

14. Cholera next appeared at Ellichpur district on 4th September, 100 miles to the north-east of the places where it first appeared, and in which it still existed. "The first case was in a boy of 14, "who was seized with vomiting and purging in the morning, and died at night. Another fatal case "took place in a boy in the same hut on the same day. A third case occurred on the 9th September "without any communication with the others. It also proved fatal. In this district four villages "were affected, and there were 7 attacks and 6 deaths."

15. Akola district, where the disease appeared on 2nd November, is about 50 miles from Ellichpur, and the same distance in an opposite direction from Malkapur. Seven towns and villages in Akola yielded cases, of which there were 53, and 30 deaths. In the neighbouring Balapur circle there were 30 deaths. "The outbreak," says the Sanitary Commissioner, "was of indigenous origin."

The Balapur cases resulted from excessive feasting at a local festival, and the town itself "is in a "very insanitary state. . . . . There are no rules whatever in force, or arrangements for the "purposes of nature in the pet. The very drains in the main streets in the pet answer the purposes "of latrines. . . . . The drinking water is defiled. Men and animals pollute it. Khasarkera "is quite insanitary and noxious." The sanitary organization is in a most defective state. This Balapur experience included one of those cases which throw light on some points of cholera history. A traveller on his way to Akola halted a day at Balapur, where cholera was present. He was taken ill at Akola, about 10 miles away, and there died, but no other case followed. There was some condition present in Balapur which was not present in Akola. There were several examples of isolated cases in villages "occurring in seven different centres without starting an "epidemic of cholera in the district."

16. We have adduced these cases from the present Report to show the kind of information supplied to us by well observed first attacks. It is in this way alone that trustworthy information about epidemics can be attained, for after the disease has shown its presence by overwhelming numbers of cases there are elements of fallacy at work which it is almost impossible to eliminate, and hence any kind of epidemic theory may be adopted, however, false in fact it may be. There appears to be no doubt of the entirely independent character of these recorded seizures. The two factors, the epidemics and local and personal predisposing causes, were both present, but the former in a mild degree.

17. *Small-pox.*—This disease presents an epidemic character in these provinces not unlike that of cholera, as will be seen from the following annual death-rates since 1871 :—

Years.	Small-pox Death-rates per 1,000.	Years.	Small-pox Death-rates per 1,000.
1871	·2	1878	9·7
1872	3·8	1879	·03
1873	3·8	1880	·02
1874	·5	1881	·08
1875	·4	1882	·10
1876	·2	1883	1·50
1877	2·9	1884	·20

Of late years the mortality has much diminished, and the intervals between periods of epidemic increase have lengthened, but notwithstanding the diminished death-rate, small-pox mortality was still sevenfold the mortality from cholera in a non-epidemic year. Small-pox deaths were returned from all the districts, and from 62 out of 113 circles of registration, and nevertheless the disease was fatal in no more than 202 population groups out of 5,501. Out of 11 towns in the provinces 7 returned 43 small-pox deaths. The town which suffered most was Basim, which lost 32, or 2·7 per 1,000, from this disease.

18. The monthly prevalence of small-pox was as follows :—

Months.	Small-pox Deaths.	Months.	Small-pox Deaths.
January	47	July	38
February	58	August	17
March	94	September	13
April	128	October	10
May	102	November	7
June	76	December	29

As usually happens the hot months yielded the most small-pox. Nearly the whole small-pox mortality of the year took place at young ages. Of the 615 deaths, 212 were under one year of age, and 384 between the ages of one and ten.

19. The birth-rate in 1884 was, as we have seen, 41·3 per 1,000 of population, the successful vaccinations were 30·3 per 1,000, and the small-pox death rate 0·2 per 1,000, while 596 deaths took place under 10 years of age out of a total mortality of 615, and the conclusion is obvious that vaccination must be advanced at the younger ages. Nevertheless the actual sum of operations has largely increased during recent times.

In the official year 1869–70 the ratio of successful vaccinations to population was only 3·2 per 1,000, since then it has rapidly risen and attained to 38 per 1,000 on two years, while in 1883–84 the rate had fallen somewhat to 30·3 per 1,000. The data show a large decrease of small-pox mortality and fewer epidemics since vaccination was introduced and extended, but the large death-rates at the younger ages show that it is not sufficient to have a high general vaccination rate unless it can be shown that the high rate is due to operations performed in the first year of age.

20. *Fevers.*—Deaths registered from fevers were those most generally distributed over the provinces in 1884. They were returned from all the six districts, from all the circles of registration, and from 4,012 villages out of 5,501. Fever deaths were likewise returned from all the towns. The registered fever deaths numbered 30,551, or 11·6 per 1,000 of the population, against a preceding five years' average of 15·1 per 1,000. There has been apparently a considerable reduction in the fever mortality in 1884 over the registered amount of the previous 16 years, which averaged 14·4 per 1,000. During the earlier years the registration appears to have been imperfect, but the rate for the last 10 years has been as follows :—

Years.	Ratio per 1,000.	Years.	Ratio per 1,000.
1875	11·9	1880	14·2
1876	18·2	1881	15·6
1877	15·6	1882	15·0
1878	38·9	1883	20·8
1879	14·8	1884	11·6

This abstract shows that fever in the Berars is liable to periods of considerable augmentation followed by decline in the death-rate.

21. The monthly deaths registered in 1884 were as follows:—

Months.	Fever Deaths.	Months.	Fever Deaths.
January	2,398	July	1,528
February	1,917	August	2,331
March	2,254	September	3,497
April	2,315	October	3,489
May	2,419	November	3,732
June	1,660	December	3,061

A diagram for each district gives the relation of rainfall to fever mortality, with the result that in all the districts the maximum fever death-rate follows the most of the rainfall. When the ground begins to dry the fever mortality rises.

22. A further analysis of the facts shows that the fever mortality varies considerably in different districts, as is shown by the following ratios:—

Districts.	Ratio per 1,000 for 16 Years' Average.	Ratio per 1,000 for 1884.
Amraoti	15·2	12·2
Ellichpur	15·5	11·0
Wun	16·8	15·8
Basim	10·0	6·9
Akola	16·2	12·9
Buldana	22·3	9·4
Total	14·4	11·6

These figures suggest some important points of inquiry. Why, for instance, should Wun return the persistently highest fever rate, and Basim the lowest? Are there any circumstances connected with the topography of districts to account for the facts, or in the habits and modes of life of the people, or in the condition of villages, or in their local position? The facts as they stand appear to show that some light at least may be obtained by following up such an inquiry. All that can be done with the case as it stands is to point out the probability of local drainage defects leading to local causes of malaria, as influencing the amount of fever.

23. The town fever death-rates slightly exceed those for the villages in the proportion of 11·9 for the former to 11·7 for the latter. The highest town fever-rate of the year was 19·8 per 1,000 from Mangrul, where a population of 6,122 lost 121 by fevers, showing the presence there of serious local fever causes.

24. *Bowel Complaints.*—Deaths under this head were 9,319, or 3·5 per 1,000 of the population. The mean death-rate for 16 years had been 6·2 per 1,000. But the annual rates had varied greatly. The lowest rates, 2·9 per 1,000, were registered in 1868 and 1869, and the highest, 12·6 per 1,000, in 1878, which was the famine year. The rates registered in different districts show the same diversities as the rates from fevers; but it will be sufficient to state that the lowest rates have been those from Wun district, which on a 16 years' mean have been 1·8 per 1,000, and only 1 per 1,000 in 1884, while the highest rates have been returned from Akola. These averaged 9 per 1,000 for 16 years, and the rate for 1884 was 5·2 per 1,000. The rate for 1884, when compared with the previous five years' average, was as 3·5 to 4·6 per 1,000. The monthly deaths registered were as follow, and they show a large increase in the latter months of 1884, corresponding in this respect with the monthly mortality from fevers:—

Month.	Bowel Complaint Deaths.	Months.	Bowel Complaint Deaths.
January	958	July	809
February	628	August	975
March	538	September	1,431
April	540	October	1,171
May	535	November	918
June	375	December	741

It would appear as if these diseases, like fever, were influenced by climatic causes. The highest town rate from bowel complaints was 5 per 1,000 in Malkapur town, situated in a cholera district. These diseases were generally diffused over the provinces, as is shown by the fact that 108 out of 113 circles returned deaths, and 1,945 villages, out of 5,501, suffered.

25. We shall conclude this sketch of the epidemic history of 1884 by abstracting the following table, showing the relation month by month, of the different epidemic death-rates to the chief climatic elements. Small-pox is augmented by high temperature as it is elsewhere in India.

Cholera was mainly an endemic disease. The months of greatest fatality from fevers and bowel complaints were the cholera months, when the humidity, rainfall, and temperature here higher. If we admit that these elements exercised a certain influence on the general health of districts, we may safely admit also that they acted injuriously on loca disease causes by increasing their activity.

Months.	Mean Maximum Temperature.	Mean Range.	Mean Humidity.	Total Rainfall.	Total Deaths, 1884. Cholera.	Small-pox.	Fevers.	Bowel Complaints.
	°	°		Inches.				
January	79·1	26·9	40	·45	—	47	2,398	958
February	86·9	28·7	33	·09	—	58	1,917	628
March	97·1	29·3	29	·39	—	94	2,256	526
April	102·5	28·1	29	·35	—	128	2,315	540
May	105·5	26·7	26	·01	5	102	2,419	535
June	97·4	21·0	50	4·47	11	76	1,660	375
July	84·3	12·0	79	12·26	—	28	1,523	509
August	85·9	13·4	73	5·91	—	17	2,331	975
September	83·3	12·9	79	14·17	14	13	3,497	1,481
October	85·4	20·3	56	2·46	25	16	3,489	1,171
November	82·3	26·3	41	··	48	7	3,782	918
December	76·7	22·9	54	5·76	—	29	3,016	741

26. *Injuries.*—Under this head were returned 177 suicides, 57 deaths from wounding, 537 from accidents, and 188 from snake-bite and wild beasts, making in all 959 violent deaths against a 16 years' average of 963.

27. All other causes yielded 23,277 deaths, or 3·5 per 1,000 of the population. But an attempt was made to classify 3,261 deaths in 120 villages, with the following results, which it is important to give, premising, however, that the village nomenclature is only approximately correct.

Diseases.	Deaths.	Diseases.	Deaths.
Zymotic Diseases.		*Local Diseases.*	
Small-pox	18	Epilepsy	1
Fevers	1,515	Sunstroke	1
Measles	4	Headache	2
Puerperal disease and childbirth.	57	Respiratory affections	489
		Jaundice	56
		Colic	43
		Hiccough	3
		Dysentery and diarrhœa	528
		Worms	20
Constitutional Diseases.		Spleen disease	1
		Piles	1
Rheumatism	39	Stone in bladder	2
Syphilis	21	Gonorrhœa	3
Scrofula	4	Abscess	4
Phthisis	8	Atrophy and debility	225
Dropsy	24	Old age	73
Leprosy	23	Injuries	44
Scurvy	7	Other causes	15

On these data the Sanitary Commissioner makes the following remarks:—Respiratory affections include pneumonia, bronchitis, and asthma. Of 225 deaths from atrophy and debility, 200 were amongst children between one and three years of age, due probably to teething, want of nourishment, &c. Deaths from puerperal fever and childbirth are considerable, "as might be expected in a "country where poor women have no skilled assistance at this critical time." Imperfect as are the data, they throw much light on death causes, and consequently on the health improvements necessary. They appear to show that, in the absence of cholera, one half of the deaths arose from zymotic diseases. That about a seventh part was due to chest diseases, a sixth part to bowel diseases, and a very large proportion to diseases incidental to weakened stamina, the result of fevers due to malaria and to the prevailing local disease causes in villages. On the whole, then, we are indebted to the Sanitary Commissioner for increasing our information on these village diseases, and we cannot do otherwise than express a hope that similar inquiries may be pursued in other Governments to prepare the way for a more efficient system of registration of death causes than has hitherto been practicable in India.

28. As regards the remarks of the Sanitary Commissioner about puerperal deaths due to want of skilled assistance in childbirth, it may not be out of place to state the present position of this question in England, where there has been no such want of skilled aid in times past, and where, nevertheless, the childbed death-rate has undergone a very remarkable reduction in recent years.

About 15 years ago the statistics of 16,774 deliveries in home practice were given by Dr. McClintock and Dr. Matthews Duncan, showing a mortality of 131 on nearly 8 per 1,000, or one death for every 125 deliveries. The fact shows that something else was at fault, and not the skill of the attendants. The Registrar-General had thrown a little light on the subject by showing that the maternal death-rate in towns was higher than in country districts, while the general death-rate was equivalent to one death in 200 deliveries. The whole question, together with the probable causes of mortality, had

attracted attention in different foreign countries as well as in England, and it was dealt with in Miss Nightingale's notes on lying-in hospitals published in 1871. Of late years a noteable reduction in the death-rate has taken place, for according to the Registrar-General's report the maternal death-rate in 1883 in England and Wales was equivalent to one death in 230 births. Again, in the Rotunda Hospital, Dublin, in the seven years ending in 1864, the deaths were one in 32 deliveries, while in the Report for 1885 the proportion was one maternal death in 126 cases.

The skill has remained the same, but it is clear that the conditions of labour have been materially improved, and that the influence of sanitary surroundings is becoming more and more recognized in childbirth and in maternity hospitals as it has been in general hospitals.

We have not the means of knowing accurately the death-rates of lying-in women in these Indian villages, but we can approach to it by calculating backwards through the death-rates given in the preceding tabular statement, with the result that the not improbable death-rate of lying-in women is somewhat about one death for every 100 deliveries. Now we know something of the sanitary state of the villages where such results are arrived at, and it would be in perfect accord with all past knowledge and experience to include a lower childbirth death-rate among the savings of life to be aimed at and anticipated by village sanitary improvements.

29. *Sanitary works (Civil).*—Berar contains seven municipalities, and the present Report gives brief but sufficient abstracts of the sanitary measures carried out in them in 1884, and there are a few points of practical interest in the year's proceedings which may be noticed for the sake of information.

30. And first as regards the death-rates, which stood as follows in comparison with the previous five years' averages:—

Municipalities.	Population, 1881.	Death-rates per 1,000.	
		1884.	Previous Five Years' Average.
Amraoti	23,538	25·4	24·6
Akola	16,614	17·6	33·5
Khamgaon	12,390	22·5	29·7
Shegaon	12,079	29·7	33·3
Akot	16,187	28·9	33·3
Ellichpur	26,226	24·8	36·5
Basim	11,576	20·2	28·4

These mortality statistics show considerable improvement in the public health, but the registration is obviously defective, and for two towns, Khamgaon and Shegaon, the five years' rates are estimates. Besides this, 1884 was a non-epidemic year, so that the figures are matters of record more than of actual fact.

The aggregate population of these seven municipalities was 118,074, and their outlay under each head of sanitary improvement was as follows in 1884:—

	Rs.
Conservancy	33,171
Drainage	7,318
Water-supply	15,995
Total	Rs. 56,484

For these purposes the year's expenditure was about a shilling a head, or about a third of the income.

The public health work done was as follows:—

31. *Amraoti.*—Surface drainage extended in the eastern part of the town, but the western part still undrained. The new water-supply was still incomplete. The source is a lake five miles from the town, and water will be laid on by pipes. Conservancy cost Rs. 10,323, or a little over 10d. per head. Bathing water is collected and carried away. The "nightsoil is carted to about a mile outside the "town, and buried in trenches. The site of these trenches has been cropped this year by the "municipality with wheat, peas, and linseed. The experiment is stated to have been a decided "success."

32. *Akola.*—"Altogether some 8,750 running feet of masonary surface drains have been completed, "and the house moris or cesspools, where they abut on the drains, open into them." A scheme for completing the drainage was being prepared. The water-supply is still in an unsatisfactory state, although much has been done by the municipality to improve it. It is proposed to construct a tank about three miles from the town, and to lay on the water by pipes. In this town the sweepings are collected by the conservancy and deposited in dustbins, whence they are sold to a contractor, an arrangement which works well, and "brings in a good round sum to the Committee every year." The house sewage is allowed to sink into the subsoil, or it is carted away by the conservancy, which is "very costly." There is no escape from the outlay, however, until the town is properly drained. The suggestion made in the report, to complete the drainage by a loan, and to connect the houses with the drains, is the only alternative, but it must be remembered that drains, whether opened or closed, require a sufficiency of water to remove the sewage to the outlet.

33. *Khamgaon.*—This small town of 12,390 inhabitants has been surface drained, and the house cesspits have been connected with them, and cesspits can now be abolished. The new water-supply, which will yield a daily supply of 20 gallons per head of the population, was nearly completed from a tank. "Pipes have been laid down in most of the streets," and masonry cisterns, hydrants, and cattle troughs were being provided. We may restate here that, to prevent nuisance and to secure the healthy action of the drainage system which has been adopted, a water-supply for washing out the surface drains continuously is a matter of necessity. In this town the nightsoil is trenched, and a very satisfactory result in the growth of tobacco and pumpkins was obtained on the site. The result has been that other people have applied to have the manure, and, if the example is followed, the great difficulty in cleansing will have been met.

34. *Shegaon.*—This town of 11,079 inhabitants is considered to be so poor, rightly or wrongly, that it cannot complete the water-supply, although a tank was provided by subscription and the water brought to the outskirts, where it still is. The town wells are all brackish. The outlay for conservancy was just a penny per head, or Rs. 779 for the whole population for the year. Nearly 6 per cent. of the inhabitants died in 1883, and nearly double this rate in 1878.

35. *Akola.*—This town has "a deep closed drain running under the principal streets, and open "surface drains discharging at points into it." This system will be extended to the whole town as funds are available. The water-supply is from wells, and is said to be good and abundant, but the sanitary condition of the supply can only be known by analysis. The drainage arrangement and water-supply are both defective. At present the house sewage is run into the street drains, or into masonry receptacles periodically emptied, "the contents being scattered over the streets." In cases such as this, the remedy required is to have a consistent scheme prepared, including the drainage and water-supply, which ought always to go together, and such haphazard execution of works, to be put aside and resumed when funds are available, is a measure always to be deprecated. It is not in this way that sanitary improvement can be accomplished.

36. *Akot* has a population of 16,137, and it expended in 1884 a sum of 602 rupees for cleansing, or less than a penny per head.

37. *Basim.*—This town of 11,576 inhabitants is drained by side cuttings in the streets. "The "deficient drainage of the civil station, which yearly gives rise to so much sickness amongst the "members of the police force, owing to dampness of their barracks, has not yet been remedied." This was reported on in 1879. The Sanitary Commissioner points out the two alternatives, either to drain the station or to remove it to a better locality. The water-supply is the same as formerly, from wells and tanks. House sewage is removed by the municipality, and the town garbage is burnt in cinerators. In this town private latrines are cleansed by the municipality, which is an important improvement, and Basim is remarkable for the amount spent on conservancy, which was Rs. 2,770, or about 6*d.* a head, when compared with the outlay in other towns, and it had the lowest death-rate, 20·2 per 1,000, in 1884.

38. *Ellichpur.*—This, which is the most populous town in the Berars, with a population of 26,728, is in a backward sanitary condition. Its surface drainage was only begun, and 97*l.* has been expended on it. Part of the town only is supplied with water from a distance by pipes, the remainder from wells and the river. Its conservancy arrangements are defective, and cost about 5*d.* per head. Its five years' average death-rate had been 36·5 per 1,000, and in 1884, without a single death from small-pox or cholera, its rate was 24·8 per 1,000, one-third of which arose from fevers.

39. The impression produced on the mind of the Sanitary Commissioner by the facts in these towns is that "steady progress is being made in works of sanitary improvement." We are not disposed to call this opinion in question, but the facts regarding the sanitary condition of the municipal towns stated in the report clearly show that a far more rapid advance is required to shield their inhabitants from those fatal epidemic outbreaks which may occur at any time under the existing sanitary conditions.

40. *District Sanitary Improvements.*—The total expenditure under this head was as follows:—

	Rs.
Civil stations	24,173
Non-municipal towns	33,053
Villages	38,691
	95,917

This amount includes the construction and up-keep of roads, serais, &c., but the sanitary expenditure was 67·5 per cent. of the sum, 31·1 per cent having been allotted for conservancy, 17·9 for drainage, and 18·5 per cent. for water-supply. Besides the outlay for current sanitary work, several important permanent improvements were carried out in the East Berar division by the Public Works Department. These included four water-supply tanks and seven anicuts. In the West Berar division a number of tanks were constructed and repaired, and surveys made. All these works ought to have an important influence on the sanitary state of districts.

41. *Jails.*—The jail construction is for 1,345 prisoners. The average daily strength in 1884 was 1,030·89. The largest number on any one day was 1,292. The average daily sick was about 1¼, and there were 9 deaths. The two jails of Amraoti and Akola, which had the largest numbers at one

tions in prison, but in each case considerably under the construction, yielded the largest percentage of daily sick, and the nine deaths took place out of 444 prisoners in Akola jail. The death-rate in this jail on its average population was 20·2, and on the whole jail population of the province it was 8·7 per 1,000. The causes of death are not stated, but with an annual admission rate of 486 per 1,000, a daily sick-rate of 10 per 1,000, and a death-rate of 8·7 per 1,000, the year's results, when compared with those in other jail districts, are favourable.

32. *Village sanitation.*—The best way to obtain an idea of the present state of this all-important work will be simply to transcribe what the Sanitary Commissioner says about it. This is as follows:—"Since the introduction of the Residents' Book Circular XVI. of 1880, laying down a code of rules "for village sanitation, considerable improvement has undoubtedly been effected, and where these "rules are observed the village site is clean and the surroundings undefiled. In many villages, how-"ever, these rules are still a dead letter. The patel knows not of their existence, or if he does, will "say they are with the patwari, with whom the circular has been so carefully preserved as to be "forgotten. What is required is that when any inspecting officer visits a village he should first call "upon the patel to produce the rules, and then ascertain if they are given effect to, or any attempt "made to carry them out, and upon tahsildars specially their duties in this respect should be strongly "impressed." This merely means that new rules, or rules new to the people, have no self-operative qualities in India, any more than they have anywhere else, and that while rules supply the instrument, the executive supplies the handle, and the two portions must always be joined together. Any way the Sanitary Commissioner has stated the principle which must be applied in practice, and skilled efficient inspection would otherwise be a means of enlightening the people, for we are told that their minds "are gradually becoming familiarized with the fact that what is required under these rules is "for their own benefit." For the same object the Government of India directed the preparation of a school book by their late Sanitary Commissioner for use in all schools, but from some misunderstanding its use in the Berars has been limited to the training colleges. We concur in the view of the Sanitary Commissioner that this primer "should constitute one of the regular class books taught "in every school, not merely in the higher classes but in the lower ones also." It was, indeed, for this purpose it was prepared.

There is an Appendix to this Report, giving detailed notes of town and village inspections by the Sanitary Commissioner, but as their general result has been already stated it is unnecessary to enter into the details at present.

In conclusion. The report for 1884 shows very good inspecting and reporting work on the part of the Sanitary Commissioner. It cannot, however, be said that it adds much to our previous knowledge of the sanitary history of the comparatively small population of these provinces. Much addition in this direction was not to be expected, but we now know for a certainty that the Berars are subject to sudden and violent outbreaks of fatal epidemics, and that no amount of inspecting and reporting can diminish this liability. In the present state of public health all that the Sanitary Commissioner can do is to repeat incessantly this fact, but to turn it to practical use for the purpose of saving life or working power to the people is beyond his power. This belongs to the executive, and it is in extended and more active work that any real good can be expected. The difficulty in the Berars, as in other parts of India, is twofold, first, deficiency of funds, but secondly, the far greater deficiency of real energy in dealing with sanitary measures in themselves of a very simple kind, and which no increase of funds could altogether overcome. All we can do is to call pointed attention to what appears to us to be the practical outcome of this Report, but it rests with the Government to take such steps as may be necessary to secure the exercise of the requisite power, whether in municipalities or villages, for removing the disease causes to which the Sanitary Commissioner has called attention year after year.

We have no intention in these remarks of implying that no good work has been done, but to a certainty the present health history of these provinces would have been different if the executive had followed more closely the leading of the sanitary history.

27th March 1886.

No. 9.

Memorandum of the Army Sanitary Commission on the Report of the Sanitary Commissioner for Assam for 1884.

1. The population adopted in this Report is that of 1881, which was 4,527,934. The registered births in 1884 were 120,483, or 26·61 per 1,000. The area of registration is not materially different from the area of 1883, and as no allowance apparently can be made for increase of population, the ratios calculated on the census of 1881 are probably too high.

2. The birth ratios vary in different districts. Leaving aside the rate of 48·38 per 1,000 returned from the 744 inhabitants of Tura, the highest rate, 41·65 per 1,000, was registered in Goalpara district. The other districts returned rates at and above 24 per 1,000, with the exception of Lakhimpur, which was 19·38 per 1,000. Birth registration is improving in all the districts, and showed a general increase in 1884 of 2·76 per 1,000 over the ratio of the preceding year. For every 100 females 109 males were born.

3. The deaths registered in 1884 numbered 132,992, or 29·37 per 1,000, hence, if the registration were correct, the deaths in 1884 would have exceeded the births by 12,509, or 2·76 per 1,000 of the

population. It would hence appear that the registration of deaths is better done than that of births, and not that the population of the province has diminished. For every 100 female deaths registered there were 113 deaths of males. The highest death-rate was returned from Goalpara, namely, 49·50 per 1,000. The birth-rate in this district was 41·65 per 1,000. Both ratios would apparently show good registration work, but large numbers are no real test of accuracy, for, if they were so, this district would show a loss of 7·85 per 1,000 of its population, which is not likely. All that can be said about the registration is that the actual numbers registered are increasing.

4. The tea garden registration has been placed in a better position by the use of a correct basis of the mean resident population, which, excluding the small numbers in the Goalpara gardens, amounted in 1884 to 260,758. The births among this number were 8,256, and the deaths 10,668, giving a birth-rate of 31·66 and a death-rate of 40·91 per 1,000 of the average population. Of course allowance would have to be made for the element of age, but still the birth-rate would supply its quota of infantile mortality to the general rate, which among people engaged in country work is on any supposition very high, and affords ample scope for the sanitary improver in reducing it. But when the district tea garden rates are taken separately, we find that some of them are excessive, and require special examination and report. They are as follow:—

Districts.	Population of Gardens.	Deaths, 1884.	Deaths per 1,000.
Kamrup	2,541	204	80·28
Darrang	23,458	1,094	46·72
Nowgong	11,318	704	62·20
Sibsagar	62,993	3,068	48·70
Lakhimpur	45,066	1,198	26·58
Sylhet	36,114	1,690	46·79
Cachar	79,268	2,710	34·18
Total	260,758	10,668	40·91

We take it for granted that, as the deaths are placed in column alongside the births, they refer to the whole population, including children under the working ages, and, if this be so, it would introduce an error into the ratios by charging the infantile mortality against the tea gardens and their management, and, to avoid such a mistake, we would suggest whether the actual deaths at the working ages and the actual working population should not be used in striking the death-rates in future, and given as well as the present data, which as they stand can only be described as lamentable.

5. The average death-rate in 10 Sadr towns was 29·87 per 1,000 on a population of 60,091, and the rate on 40,459 inhabitants of 12 sub-divisional towns was 35·39 per 1,000. The Sadr towns present some extraordinary registration results. Shillong, for example, returns the births of 84 males for ever 100 females, and the deaths of 350 males to 100 females. This is the worst case, but the others present similar instances. They are perfectly well known, and are accounted for on the spot by the present state of the machinery, but with all the errors there is evidence that in the midst of great difficulties the work is advancing, and we must hope for the best.

6. *Causes of death.*—The following were the registered death causes in 1884:—

Causes.	Total Deaths.	Deaths per 1,000.
Cholera	22,276	4·92
Small-pox	4,781	1·06
Fevers	66,527	14·69
Bowel complaints	16,157	3·57
Injuries	1,180	0·26
Other causes	22,071	4·87
All causes	132,992	29·37

The difference between the general death-rate of 29·37 per 1,000 in this table and the previous five years' average rate of 18·68 per 1,000 is solely due to the extended area of registration and improved record.

Under such conditions it is not possible to give a trustworthy account of the past disease history, and we must take the figures given in the Report as the best attainable at present.

7. *Cholera.*—The following registered deaths from this epidemic have been returned for the last four years:—

	Deaths.
1881	5,010
1882	21,055
1883	14,908
1884	22,276

The largest cholera mortality in this group of years was in 1884. It amounted to 4·92 per 1,000, against a previous five years' average of 2·73 per 1,000. This, however, does not include a few deaths in the Khasi and Jaintia hills and Tura, which have only recently made returns.

8. In the year under review all the nine districts returned cholera deaths 21,824 in number, or 4·93 per 1,000, and of the 22 towns three only escaped the epidemic. The others returned 452 deaths, or 4·49 per 1,000. The highest death-rates of the year were returned from the towns of Mangaldai and Nowgong, and these were 17·34 and 16·95 per 1,000 respectively. Nowgong district returned the highest district rate of the year, namely, 8·85 per 1,000. Cholera was generally distributed over the province. Deaths from it were returned from 415 circles of registration out of 661. There are 16,205 villages, but all those returning deaths are not given. The number which made returns was 3,551, or above 23 per cent. of the villages in the same districts. The deaths returned by villages would average four deaths per village.

9. The monthly incidence of cholera was as follows for the whole province, but, as we shall see, its incidence varied considerably in the two great valleys :—

Months.	Cholera Deaths.	Months.	Cholera Deaths.
January	204	July	2,428
February	258	August	1,069
March	1,052	September	984
April	1,979	October	1,442
May	4,254	November	2,811
June	3,866	December	1,984

As these figures stand, they appear to be a record of two consecutive epidemics, but the real facts are shown in this abstract :—

Months.	Registered Deaths from Cholera.			
	Brahmaputra Valley.	Surma Valley.	Hill Districts.	Total Deaths.
January	131	71	2	204
February	55	202	1	258
March	629	417	6	1,052
April	1,370	603	6	1,979
May	2,593	1,645	16	4,254
June	2,942	910	14	3,866
July	2,196	188	39	2,428
August	390	109	70	1,069
September	616	227	91	934
October	675	706	61	1,442
November	798	2,006	12	2,811
December	222	1,761	1	1,984

These data are only for a single year, yet they show that in 1884 the epidemic history was by no means the same in the two valleys. From figures in the Report it is obvious that while the epidemic history of the Brahmaputra valley was essentially the same in 1883 as it was in 1884, the Surma valley epidemic in the latter year approached more nearly to the monthly course of the Brahmaputra cholera than it did in 1883.

10. This subject is of considerable importance in the topographical and climatic history of cholera, and as a further contribution to its elucidation we shall place side by side the cholera deaths and rainfall in Nowgong and Sylhet, the former in the Brahmaputra, the latter in the Surma valley :—

Months, 1884.	Nowgong.		Sylhet.	
	Cholera Deaths.	Rainfall.	Cholera Deaths.	Rainfall.
January	—	0·07	58	0·07
February	2	1·14	114	2·52
March	12	2·37	303	10·52
April	32	4·32	435	15·05
May	61	6·19	979	25·45
June	348	9·74	544	17·41
July	651	17·80	136	13·85
August	325	13·07	94	41·25
September	263	5·66	208	7·01
October	394	3·12	694	12·01
November	536	0·12	1,947	0·94
December	148	—	1,685	—
Total	2,782	63·60	7,197	114·11
Ratio per 1,000	8·96	—	3·65	—

This abstract shows the influence of rainfall on cholera in two typical cases, both as regards its amount and distribution.

In Nowgong, with less than half the rainfall in Sylhet, the cholera death-rate is much more than double. In Nowgong the death-rate rises with decrease of rain. In Sylhet, at the time the rainfall is so great as to flood the country, cholera mortality undergoes a marked diminution, but it again increases when the flood waters have passed away and the earth surface has re-appeared. "All the "circumstances which are said to promote the spread of cholera and aggravate its intensity exist in "Sylhet everywhere,—high temperature, a moist stagnant atmosphere half the year round, lowness "of position, unwholesome food, bad water, and defective sanitary arrangements generally." This is Dr. Macnamara's account, and the Sanitary Commissioner adds to it, "crowded population on "many areas." Nevertheless, in the presence of these local causes, climatic conditions, together with local topography, appear to exert a palpable influence on cholera in the Surma valley. Anyway, the rainfall cannot be interfered with, but we can deal with the local causes which unfortunately we cannot compare with those of Nowgong district, in which the maximum mortality of the year took place, because the local reports give no account of them, at least specifically, but they leave no doubt of their existence, much as they have been hitherto, and we may safely accept the following view of the Sanitary Commissioner as showing generally what are the common predisposing causes of cholera in Assam:—"The statistics of cholera in the province during the year are illustrative solely "of the fact that the disease is persistently endemic, with periodical epidemic outbreaks of great "severity. As yet no progress has been made towards reducing this annual grievous mortality "by the introduction of large sanitary measures. In Shillong alone has a pure and undefiled "water-supply come into the daily use and habits of the people, but this is no test, as cholera has "only once (1879) been epidemic in this station. Elsewhere in Assam sanitation in degree "commensurate with the occasion has no place, and the rise and fall of cholera is wholly dependent "on natural laws which are not yet fully understood. The only consistent observations are that the "flood of waters spreading over the Surma valley is associated with a temporary disappearance of "the disease, and that February is almost always the month in which cholera is at a minimum "everywhere. Until sanitary measures are supported by a much greater local expenditure" (and we would add with far more energy and perseverance than appears to have been spent on them, a matter of more importance than money), "the annual statistics are simply a reflection of unchecked "waste of life."

11. *Cholera in the tea gardens.*—We have already seen that the cholera death-date for the whole of Assam was 4·92 per 1,000. In the tea gardens there were 2,161 deaths from the epidemic, or 8·3 per 1,000 of the tea garden population, not far short of double the rate for the province. The mortality was distributed as follows:—

Districts.	Cholera Deaths per 1,000 of Population.	
	General Population.	Tea Garden Population.
Kamrup	5·62	29·4
Darrang	6·46	11·8
Nowgong	3·95	14·3
Sibsagar	5·24	10·0
Lakhimpur	2·55	4·3
Sylhet	3·69	7·5
Cachar	5·89	7·6
Total	4·92	8·3

The tea garden registration is no doubt more accurate than that of the districts, and hence the comparison presented by the figures is not absolute. But this objection does not apply to the tea garden mortality, which presents a record of very high cholera death-rates, among a body of people under control and having medical officers on the spot. It is necessary to ask why it is that so many lives are annually sacrificed from cholera in these establishments. We have suggested this inquiry in former memoranda, but the mortality only is reported in 1884 without any corresponding account of the local causes of this great sacrifice of life, or what is being done to prevent it in future. We have, however, the views of the planters on the subject, as follows:—"Dr. Campbell connotes the "general opinion of the tea planters that cholera is introduced in their gardens by newly imported "batches of coolies, while at the same time it is admitted that the coolies are landed from the "steamers in good health, that cholera is prevalent generally in the district, and that some time "elapses before the coolies are themselves affected." The facts appear to show that there are causes of some kind in the tea gardens themselves which predispose the coolies to attacks of cholera during epidemic seasons, and we would suggest that rigid inquiry should be made into the conservancy arrangements, water-supply, and drainage of the localities where the workpeople live. Something must be at fault. The Sanitary Commissioner adduces this case, and also another instance of hypothetical causation from the passage of a train of coolies during the Aka expedition, whose habits no doubt were far from cleanly, but he adds that "their habits could not be worse than the resident "population, or the labourers on tea gardens," a remark which throws light on the cholera among tea garden coolies, and shows where the remedial local evils should be sought for and dealt with by

the tea garden authorities. As the Sanitary Commissioner very properly remarks on these alleged importation occurrences, they show "how readily blame is thrown on exceptional occurrences, while "every detail commonly supposed to favour cholera outbreaks is present ordinarily in the vital "conditions of the complainants."

It is from such attempts to shirk responsibility, as we have often pointed out, that danger to real sanitary work arises in India as everywhere else, and which for many years have led people to throw the blame of cholera on the legitimate pursuits of commerce instead of on their own foul seaports, and their general neglect of sanitary work.

12. *Small-pox.*—There were 4,781 small-pox deaths in Assam districts in 1884, against 6,162 in the preceding year, and 3,129 in 1882. The death-rate in 1884 was 1·05 per 1,000, while the previous five years mean was ·72 per 1,000. Small-pox deaths were registered in all the districts in 202 registration circles, and in 1,483 villages, but the returns for three districts do not give the number of attacked villages. Ten towns out of 22 returned small-pox deaths. The district death-rate was 1·02, and the town rate was 2·39 per 1,000. It seems probable that part of this difference may be due to better town registration.

13. The monthly prevalence of small-pox is shown by the following abstract of deaths :—

Months.	Small-pox Deaths.	Months.	Small-pox Deaths.
January	436	July	336
February	583	August	248
March	796	September	118
April	788	October	69
May	800	November	68
June	545	December	94

Out of 4,781 small-pox deaths 990 were under one year of age, and 2,375 between 1 and 12 years of age. As the numbers vaccinated at the same ages are not stated, we have no means of connecting the facts, but the very large proportion of deaths under 12 years of age shows the need of extended vaccination among children. There were 253 small-pox deaths in the tea-gardens, somewhat under 1 per 1,000 of the population, but of these deaths 146 took place in Cachar district, where the disease yielded the highest rate of the year, which was 2·37 per 1,000, while the tea garden rate exceeded 1·8 per 1,000, showing that the more severe character of the disease in Cachar influenced the death-rate in the tea gardens.

14. *Fevers.*—Besides the statistics there is little additional information under the head of fevers in the present report. The actual mortality, so far as this has been registered during the last three years, has been the following :—

Years.	Total Fever Deaths.	Ratio per 1,000 of Population.
1882	60,622	13·38
1883	67,494	14·90
1884	66,527	14·69

The mean fever death-rate for the preceding five years was 10·15, but this affords no proof that fever mortality has been on the increase. It only shows that more deaths were registered.

15. Fever deaths were registered in all the districts, and the numbers registered differed very greatly in them. Leaving out the less populous areas, we find that the fever-rates as registered were between 8·81 per 1,000 in Lakhimpur and 38·03 per 1,000 in Goalpara. In such a climate as exists in Assam, these figures only show the state of the registration, and not the fever prevalence. Deaths were returned from 540 circles of registration out of 661, and a large proportion of the villages (10,667 out of 16,205) suffered. But even these last figures show that many deaths registered under the fever heading in some districts must have escaped registration in others. This result is, moreover, rendered more probable by the fact that all the circles in Goalpara, Darrang, and Sylhet returned fever deaths.

16. The registered monthly fever deaths were as follows :—

Months.	Fever Deaths.	Months.	Fever Deaths.
January	4,838	July	6,121
February	4,260	August	5,629
March	4,162	September	5,535
April	4,540	October	5,935
May	6,275	November	6,285
June	6,952	December	5,920

All the 22 towns returned fever deaths, and their rate was 10·93 per 1,000.

17. The best way to obtain information on the relative prevalence of fever and rainfall will be to take two districts, Goalpara in the Brahmaputra valley, and Sylhet in Surma, rather than to add together all the district falls and the fever deaths. This comparison stands as follows:—

Months.	Goalpara.		Sylhet.	
	Fever Deaths.	Rain.	Fever Deaths.	Rain.
		Inches.		Inches.
January	1,338	0·24	1,697	0·07
February	1,283	0·34	1,334	2·52
March	1,159	5·47	1,379	10·02
April	1,318	7·86	1,507	14·05
May	1,676	14·62	2,099	25·46
June	2,009	15·15	2,358	17·41
July	1,687	6·95	1,842	13·35
August	1,268	3·74	1,875	6·25
September	1,151	3·39	1,635	7·61
October	1,288	2·28	2,192	12·03
November	1,399	—	2,593	0·94
December	1,405	—	2,222	—
Total	16,976	65·25	22,933	144·11

The Goalpara rainfall is that of Dhubri, the head quarter town, and that for Sylhet is of Sylhet town.

The general result is that in Goalpara district, with a total annual rainfall of 65·25 inches, the fever death-rate averaged 35·03 per 1,000, while in Sylhet, with a rainfall of 144·11 inches, the fever death-rate was 11·64 per 1,000, affording a clear indication that the amount of fever depends on other factors than the amount of rain. In Goalpara the monthly fever-rate attained its maximum together with its maximum rainfall. But in this case the fever deaths in the months following were more numerous than in the months preceding the maximum rain. In Sylhet there was also rise in the fever-rate after the decline of rain.

The practical conclusion in either case would be that Assam is very decidedly a malaria generating country, while, so far as local information can be obtained, the disadvantages of sites are not lessened, but increased, by other local causes which in all probability bear a very important relation to the prevalence of these fevers.

On the other hand, the Sanitary Commissioner states that "the body of registrars name fever as a "cause of death simply because there had been a symptomatic increased temperature sensible to an "ignorant observer." We cannot, therefore, rely on the nomenclature for guidance in sanitary work. As the case stands, the Report estimates that perhaps one third of the so-called fever deaths "are climatic or malarial, and due to natural causes, under which the people must live and die for "generations to come; a third are probably due to the habits of the people, their insufficient "clothing and bedding, their exposure, their food, and privations, and the remaining one-third would, "under a more perfect system of registration, be entered under other classes of disease."

18. To the malarial group must finally be assigned the *Kala Azar*, which local inquiry has discovered to be only a local name for malarial fever and its consequences. The darkening of the skin, from which it take its name, is an exceptional character, and its fatality is partly due to the difficulty of bringing the scattered cases under treatment, and partly due to the unfounded idea of its contagious character, which leads to neglect or even to exposure of the sick. Government is doing what it can to provide medicine and attendance, but the following statement by the Sanitary Commissioner shows what the obstacles are, while it points out the difficulties in the way of sanitary work generally. He says, "Villages where great mortality had been reported could not be reached; "there are no roads, the jungle and forest tracts are wide and dense, with marshes, rivers, river "ponds, and ditches all over the place, and even the police find it impossible to keep communica-"tions open for several weeks at a time." And again, "The village sites were badly placed for "drainage, the homesteads and dwelling-places were most insanitary, the water-supply of each "homestead was truly abominable, the food stuffs defective both in staple, nourishment, and variety, "and the clothing insufficient." No doubt the difficulties in the way of improvement are great, but so far as the facts lead us, they appear scarcely to warrant the despondjng conclusions which follow. He adds, "To provide wholesome water for each village, to drain the district, to change all the "village sites, to clear the jungle about and burn it, are impossible measures." Of course, under any Government charged with the sanitary care of a country such as this is, if these simple things cannot be done, it becomes a clear duty to remove the people, and in Goalpara at least the Report appears to consider the land tenure as the final cause of the whole evil. With this consideration we have nothing to do, more especially as it is clear that the whole question of these fevers is part of the epidemic question of India, and as such it is simply a question of village organization and improvement. The people, no doubt, are in a low state of civilization, lower perhaps than they are in other provinces, but still it is far from certain that they cannot be guided in looking after their own interests in these matters. At all events, it would be better to try what can be done in a single thana than to throw up the whole case as hopeless.

19. *Fever in tea gardens.*—The fever-rate in these gardens was 6·4 per 1,000. A low rate if the nomenclature were the same as that in use among the civil population. This, however, is not likely to be so, as the garden Medical Officers diagnose the cases.

20. *Bowel complaints* were returned as death causes in 16,157 cases, or 3·56 per 1,000 of the population against a previous five years' average of 2·35 per 1,000. The Sanitary Commissioner considers the reporting imperfect, which we must hope to be the truth of the matter for the sake of the tea garden administration, for the year's statistics give a death-rate among the coolies from bowel complaints of 10 per 1,000.

21. From *Injuries* there were 1,180 deaths recorded, or ·26 per 1,000 of the population. Under this head were included 68 suicides, 808 deaths from wounds and accidents, and 304 from wild beasts and snake-bite.

22. *All other causes.*—There were 22,071 deaths, equal to 4·87 per 1,000 registered under this head. No details had been received to indicate the causes of death in these cases, but it may be of interest to give the following general statement on the subject:—"Goitre is endemic in the Newgong "district. . . . . Syphilis is common among the out-patients in all district dispensaries. . . . . "Scurvy, measles, chicken-pox, mumps, whooping-cough, are almost unknown, or at least are not "recorded as fatal."

23. Speaking generally, the registration in Assam is improving so far as numbers are concerned, but it presents one singular anomaly, that with a registered death-rate of 29·37 per 1,000, no less than 82 per cent. of this rate is attributed to the four epidemic or endemic diseases, "cholera," "small-pox," "fevers," and "bowel complaints." It need scarcely be said that such a proportion is not at all a likely one, and that it shows both defect in numbers, and unskilled diagnosis.

It may, however, be accepted as a practical conclusion from the year's disease history that the sanitary work most needed in Assam is that which will best cope with the strong epidemic liability of the population. What this liability ends in is stated by the Sanitary Commissioner in the following paragraph of the present Report. He says, "Since I have been in the province nothing has "struck me more than the few and rare appearance of men and women just beyond middle age, and "very old ones. But after reading the statistics of epidemic diseases, and learning the conditions of "life in Assam, one ceases to wonder that few should survive so many dangers for 50 years."

24. The sanitary explanation of this state of the case is simple enough, and is as follows. After escaping the perils of infancy and childhood, during which many perish, the apparently "fittest" to survive and form the future backbone of the population are those who attain to adolescence, but their actually becoming "the fittest" by no means follows from their having survived the dangers of early ages, because, as a matter of fact, they become liable at this period to fatal attacks of epidemics, and the most promising and most productive periods of human life are precisely the periods yielding the largest per-centages of epidemic deaths, as well as of epidemic cases which depress the subsequent vital sources of all who suffer. Hence the "unfittest" are those who survive, and the "survival of the fittest" can only be rendered a fact, in human history at least, by destroying the causes of epidemics. This survival is hence a conditional and not an absolute fact, and the Sanitary Commissioner has shown what are the results of attempting to ignore the condition, which is not peculiar to Assam. It is universally binding, and hence the prevention or removal of local causes of epidemics, and the consequent survival of adolescents through the epidemic ages results not only in effective present working power, but in continuing the stream of life into mature old age.

25. *Sanitary works (Civil).*—After the preceding discussion, it is scarcely necessary to discuss the year's sanitary works, because the statistics show how little has been done. In the Report is given a list of 20 towns, unions, stations, and municipalities, with the amounts expended in each for sanitary purposes under the following heads:—

	R.	A.	P.
Drainage	6,435	12	11
Water-supply	3,880	13	10
Conservancy	18,347	2	1
Disposal of dead	122	4	0
Roads and culverts	27,630	14	4
Markets and slaughter-houses	3,570	4	9
Village sites	—		
Other sanitary improvements	3,013	13	11

There was thus an outlay in 1884 for all sanitary purposes, including 2,763*l.* for roads and culverts, of about 6,300*l.*, and for special sanitary work the expenditure was thus only 3,637*l.*

But even this amount was unequally distributed among the 20 population areas. Thus in nine there was no outlay for drainage. In 12 there was no outlay for water-supply. Three were not provided with funds for cleansing. In only three was there money expended on the dead. In 10 there was no outlay for markets and slaughter-houses, and nothing was spent in improving village sites.

26. The notes of the Sanitary Commissioner on the local expenditures are mainly devoted to telling us what has not been done, and the consequent deplorable sanitary condition of many localities.

27. A few abstracts will show what is the present sanitary state of the towns. For example, he repeats Dr. De Renzy's statement, that "in some places people bury their dead in their own houses "and compounds, and in one place, he says, 'I saw the dead left exposed to carrion birds.'" One Civil Surgeon reports that he saw a cholera patient being buried after death inside a house. Of course, the remedy for such practices is well known, only it is not applied. The water-supply allotment of 388*l.* is too small to have made any difference in the present system.

Taking the towns individually, the Sanitary Commissioner states that on visiting Dhubri last December he found marks of improvement, but that much remained to be done for "foul drains, "stagnant tanks, uncleansed privies, and festering refuse." In this town the municipal authorities have actually permitted the digging of enormous pits for brick making, which will of course become potent disease causes. This practice has in times past done incalculable mischief to the health of towns and villages all over India, and should be summarily forbidden. Indeed, one of the most obvious sanitary improvements required all over India is the filling up of all these pits. It is satisfactory to know, however, that the emigration coolie depôts were in excellent order, "and every "sanitary detail most carefully watched," and that the Vice-Chairman of the Municipality "interests himself greatly in sanitation, and knows thoroughly what is desirable.

Goalpara.—This is a small town with 6,697 inhabitants. Its death-rate in 1884 was 41·95 per 1,000, which appears to be a low rate, as the previous five years' average is given at 56·14 per 1,000. Its water-supply is what it was, but in regard to the drainage there is the following statement:—"The extensive drainage scheme is complete as to the main channels, and has worked for the last "two years. It seemed to me to have done no good. It has cost Rs. 10,000, but the results seem "very inefficient. The extent of low wet marsh land, of stagnant bhils and tanks, were there as "of old, and I could not see that any delivery current towards the Hanslar jheel had been effected." This would appear to show that the work was one not adapted to the case. Any way, the town and its vicinity appears still to stand in need of drainage.

28. The Sanitary Commissioner has placed in the same line the two following facts, as if they stood to each other in some necessary sequence. "The conservancy of the town cost Rs. 81 only, "and the dispensary Rs. 540." Such co-related facts have occurred before in the beginning of sanitary improvement, and in order to enforce the lesson we may cite the following analogous case of a fever-stricken English town, on which an excellent sanitary report was made very nearly a century ago.

This report was acted on in the beginning of the present century by the municipality, and a Bill for improvement was brought into Parliament, which was, however, defeated by the parishioners, who nevertheless laid a rate of 9*d.* in the pound to build a fever hospital, and provide a pauper graveyard to bury the dead. But this was not the worst, for the local fever causes went on unchecked and still manifest their presence after enormous outlay for their removal. The lesson, of course, is that sanitary work is essentially preventive in its nature, while dispensaries and fever hospitals are costly palliative expedients. Sanitary work requires forethought and skill, while the palliative measures only require money, which is also needed for sanitary work. But the difference is that sanitary expenditure, if properly applied, is in its nature accumulated capital, while relief work is wasteful outlay, so far as ulterior advantages are concerned.

In Goalpara every 30 inhabitants have their cleansing done at the cost of one penny per annum, and we need not wonder that the dispensary costs 54*l.* a year.

29. *Kamrup.*—The following passage from the Civil Surgeon's report refers to a very common disease cause in India, and one we have often referred to:—"Cholera was most persistent in a cluster "of houses on the southern bank of a foul tank in front of the Judge's house. The exhalation from "this tank is so bad at certain seasons of the year that even passers by suffer severely from breathing "it. The water is simply putrid (the river is not far off), yet is used for domestic purposes by the "people living near. I feel confident that when these foul tanks are filled up, there will be a great "improvement in the health of the town." Now, here is a case in which there would be no hardship and a great advantage in suppressing what is simply a dangerous nuisance.

The new waterworks for Gauhati "have been greatly delayed, and the "district officer is unable to "say when they are likely to be completed." Not a very satisfactory state of matters.

Barpeta, a town of 13,758 inhabitants, and a death-rate of nearly 4½ per cent., spent Rs. 250 on dispensary repairs, which were no doubt necessary. But "no money was allotted to water-supply, "disposal of the dead, vaccination, markets, &c."

"The conditions under which these people live, the severe epidemic outbreaks they experience, "their bigotry and opposition to reforms," have been frequently dwelt on.

Tezpur is a coolie depôt, "under close sanitary supervision." Nevertheless, out of 3,701 coolies and dependents who had passed through it, five had died of cholera.

Mangaldai is a village of 692 people, of whom 12 died of cholera and 23 of fever. There was one death from bowel complaint. There were in all 38 deaths, or 54·91 per 1,000. In this case 36 deaths were due to epidemic diseases, one death to snake-bite, and one cause unknown. We are told, regarding this place, that "the water-supply is always bad, and this year, owing to scanty rains, it has "been worse. Cholera, small-pox, fevers, recur periodically." Then let a proper supply be introduced, and the place otherwise improved. For so small a place, ten deaths would have been a probable loss under good conditions.

Nowgong "has many natural advantages," but a death-rate in 1884 of 56·96 per 1,000, a considerable part of which, however, is made up of deaths in the dispensary and among prisoners. Out of 4,248 inhabitants, it had a fever death-rate of 11·29, a bowel complaint death-rate of 14·36, and a cholera

death rate of 16·95 per 1,000, hence its epidemic death-rate was 42·60 per 1,000. So far as these data lead us, this town stands in need of cleansing, surface drainage, and water-supply

Sibsagar.—This town of 5,868 inhabitants and a five years' death-rate of 25·05 per 1,000, which in 1884 had fallen to 19·24 per 1,000, of which 1·70 was due to cholera, and 5·45 to fevers. This town had been actively improved by providing latrines, cleansing, and a good supply of water.

These are the chief points in the reports on Bramaputra towns.

30. The towns in the Surma valley present much the same sanitary defects, such as want of proper drainage, defective cleansing, impure water.

The Sadr town, Sylhet, appears to have an inactive municipality, with an average five years' death-rate of 31·58, and a rate for 1884 of 31·99 per 1,000. The death-rates would indicate considerable quiescence in the matter of sanitary work. We are told, indeed, that little material advance has been made. "The public and private latrines are neglected beyond all description, the uses of tanks "for washing, bathing, and drinking are still common, burial ground beyond municipal limits are "not yet enforced, overgrown and noxious vegetation increasing, and the drainage entirely "insufficient." This town has 14,407 inhabitants, and an income of Rs. 28,290, of which Rs. 13,487 were set apart for sanitary work, or less than a rupee per head, and the Vice-Chairman of the municipality reports that "the limited income of the municipality is the principal obstacle to all "improvements." Now, as we have seen, the Sanitary Commissioner has pointed out the chief improvements required, and not one of these requires the execution of works or any excessive outlay. As has been proved in other cases, sufficient improvements can be carried out at very small outlay, but this requires what is far more important than money, namely, efficient active work. Can it be said, on the facts stated by the Sanitary Commissioner, that the present income could not answer, or that any added amount would ensure the work being done. We doubt whether affirmative replies could be given, so that, in our view, the municipality should be required to abate the nuisances of which the Sanitary Commissioner complains. Let them manage their income, such as it is, to this end, and see that the work is done, and they will make more real progress by acquiring sound habits of making the best of their means than by calling for help from outside. This remark applies to most other local sanitary administrations in India.

31. Before concluding this Memorandum, we are desirous of calling attention to the present sanitary condition of tea garden coolies, dealt with in a separate Appendix to this Report.

It appears that the mean population in these gardens amounted to 260,758, as we have already stated. This number, however, includes women, children, men of working ages, infirm and old people.

In the course of the year there were 8,604 births among them and 10,853 deaths, yielding a death-rate of 41·62 per 1,000. This rate can scarcely be compared with the general Assam rate, 29·37 per 1,000, because the general registration is defective. The town rate, which may be supposed to be better recorded, was 32·09 per 1,000. This rate would place the tea gardens in an unfavourable sanitary condition. But then we have higher rates in individual localities, such, for example, as 49·67 per 1,000 among a population of 436,642 in Goalpara district, and 42·23 per 1,000 among 13,758 people in Barpeta town. It will thus be apparent that the statistical information supplied by the gardens is defective, because the population (only part of which is engaged doing work for the companies) is treated statistically in one group. It would hence scarcely be fair to charge the high death-rate against the management. What is wanted is classification and separation of the workers from the general population, and allowance should also be made for children and old non-workers in the mortality returns. All we can do at present is to state our opinion that in those groups of population engaged in the tea gardens the death-rate is excessive, while the statistics appear to show that the losses in the case of communities under the immediate supervision of European planters and their agents are greater than the average of other groups of population, a fact which ought to lead to greater care over these poor people.

The facts have received the earnest attention of the sanitary and other authorities, and the causes appear to be the following:—

First, the change of conditions and habits among the immigrants.
Second, unsuitable food and bad cooking.
Third, defects in drainage and water-supply.
Fourth, general inattention to sanitary requirements of dwellings and house necessaries, including bedding.
Fifth, drunkenness.

Now it is clear that, whatever may be the mortality among the workers, we have here a case in which a great body of people is removed from home, placed in new conditions, and there is plenty of experience to show that high death-rates are certain to result unless the surroundings are properly attended to. The mere fact that there is "terrible mortality among the new arrivals" shows this. Hence the whole question is a purely administrative one, and the result to be aimed at is simply to see that the conditions of life of these working people, removed from their own localities, are adapted to the change. Such appears to be the view of the authorities, and we would strongly advise that this view be acted on. The subject is not a new one. It has been thoroughly discussed, and what is wanted is greater activity in bringing about the necessary reforms.

32. The same Appendix gives an account of another year's experience of cholera among immigrant coolies on board river steamers, and the general question of its causes and remedies may be considered as solved. There might, indeed have been no question, if the very one-sided cholera water etiology had not been put forward, to exclusion of other predisposing causes. In our last year's Memorandum it was stated that coolies arriving at Dhubri were to be forwarded in mail steamers making quick

voyages, instead of by the usual slow means of transit; the presumption being that whatever risks were incurred on the river would, of course, be diminished by shortening the voyage. It so happens that the first year of this improvement was attended by a death-rate of 2·6 per 1,000, the lowest on record. This death-rate for a voyage of four or five days is, of course, enormous, but in 1878 the rate was 33·8 per 1,000 for a 16 days' voyage. The Sanitary Commissioner attributes the improvement to the good sanitary arrangements on board mail steamers, which, moreover, are not allowed to carry above 175 immigrants on board; cleanliness is observed, the cooking is good, "the latrines are "models of what such conveniences ought to be," and the cubic space and area are "sufficient;" there is good water and suitable hospital accommodation, and he considers that "the protection from "inclement variations of temperature is all that is necessary."

We have already strongly insisted on the importance of this consideration, especially at night, and until it is supplied the real death-rate due to river passages will not be known.

The Dhubri depôt, from which immigrants are now mainly embarked, is reported to be in excellent sanitary condition, but it appears to be too small, for coolies had to be sent on board slow craft to make the long voyage. This subject is of importance in relation to further extension of tea gardens, requiring a large increase of labourers. There is no information about immigrants to the Surma valley.

Lastly. We have had much satisfaction in former years in noticing improvements in water-supply of several towns in Assam, but although the present report gives a very full statistical account of the year's health conditions, the Government of India has pointed out its real defect in the half line in their Resolution on it, "The record of sanitary improvements is small." We are glad however, to see from the proceedings of the Chief Commissioner that there is every desire to forward improvements if means were available. We have already stated our view that more activity in the localities themselves in forwarding the work, even with the means at disposal, might very well be shown. The people should learn that in small places whatever is required for protecting health ought to be done by the people themselves, and that, if they do not choose this course of action, they must pay somebody else to do their work. This ought to be the duty of every municipal government.

Villages, of course, require a separate treatment, such as we have laid down in our "Suggestions."

16th April, 1886.

No. 10.

Memorandum of the Army Sanitary Commission on the Report of the Sanitary Commissioner of British Burma for 1884.

1. The population on which the vital statistics of Burma are calculated in this report for 1884 is assumed at 3,653,620, and as the registration is still imperfect, the year's statistics are only approximations to the truth. All that can be safely deduced from them are the numbers of births and deaths entered on the registers, but as will be presently seen the ratios are quite unreliable.

2. In 1884 there were registered the births of 42,747 males and 40,036 females, together 82,783, showing a birth-rate on the assumed population of 22·66 per 1,000.

3. The deaths registered in the same year were, of males 39,079, of females 30,155, together 69,234, yielding a death-rate of 18·95 per 1,000. Although neither rate represents the facts, we may accept the result that in 1884 the birth-rate registered exceeded the death-rate registered by 3·71 per 1,000 for the entire province. But when the 20 towns are taken by themselves, their conjoint population of 425,775 yielded a birth-rate of 23·28 per 1,000, and a death-rate of 36·65 per 1,000, showing a decrease of 13·37 per 1,000, which, if correct, would represent a loss of town population of 5,693 during a single year. It may be safely inferred that the year's death-rate is much nearer the truth than is the birth-rate, and the figures appear to show that the defect in this case has been in birth registration.

4. It is unnecessary for our present object of calling attention to the need of improving the registration of births and deaths to pursue the subject further. The authorities are fully alive to present inaccuracies, as well as to the difficulty of dealing effectually with them; but the facts show anew the importance of pressing forwards the improvements required in this fundamental part of public health administration.

5. If the year's statistics are unreliable as a whole no great dependence for sanitary purposes can be placed on the statistics of disease. We must, however, deal with them as they are given in the report. They stand as follows:—

Diseases.	Deaths.	Deaths per 1,000.
Cholera	5,515	1·51
Small-pox	6,102	1·67
Fevers	29,534	8·08
Bowel complaints	3,719	1·02
Injuries	522	·14
All others	23,862	6·53
All causes	69,234	18·95

6. Following the same order, we shall give briefly such information as the report contains under each head of mortality, beginning with cholera, from which 640 deaths were registered in 1872, and since that year the yearly registered mortality has been as follows:—

Years.	Deaths from Cholera.	Years.	Deaths from Cholera.
1873 - - -	8,109	1879 - - -	1,828
1874 - - -	960	1880 - - -	2,638
1875 - - -	761	1881 - - -	5,239
1876 - - -	3,678	1882 - - -	7,177
1877 - - -	7,276	1883 - - -	2,486
1878 - - -	6,759	1884 - - -	[illegible]

These figures, if reliable for the 12 years, would appear to show that epidemic cholera in Burma has periods of increase followed by rapid decline, and more gradual augmentation. But in a long narrow scattered country like Burma nothing very definite can be predicated in this matter for the country as a whole, although it is not unlikely that the different regions of it, if the statistics were accurate, would have each its own topographical cholera history. This fact, indeed, is indicated by the cholera history of 1884. Thus, in the Northern or Arakan division there was no cholera in January, February, and March. At the Southern end of the country, in Tenasserim division, there were only a few scattered cases, except in the months of November and December. The sea coast divisions suffered little during the earlier months of 1884, while the weight of the epidemic fell on Pegu and Irrawaddy divisions in the river deltas. Taken over the whole country, mortality was as follows:—

Months.	Cholera Deaths.	Months.	Cholera Deaths.
January - - -	57	July - - -	1,112
February - -	85	August - - -	487
March - - -	321	September - -	522
April - - -	445	October - - -	592
May - - -	401	November - -	448
June - - -	431	December - -	634

Although Arakan division suffered very little until after July, its death-rate when the epidemic arrived was the highest divisional death-rate, namely, 2·11 per 1,000, while Pegu and Irrawaddy, in both of which cholera prevailed every month, had death-rates of 1·36 and 1·99 respectively.

7. Within the divisions themselves the epidemic was made up of sparse village outbreaks.

Out of 843 circles of registration 706 escaped the disease altogether, and all the deaths were returned from 227 villages, leaving 14,584 unaffected. Generally the towns suffered more than the villages in the proportion 2·68 per 1,000 for the former and 1·51 for the latter. In Arakan division, which had a cholera death-rate of 2·11 per 1,000, Akyab district had a rate of 1·70 per 1,000, but Akyab town had a rate of no less than 6·86 per 1,000, showing clearly the influence of bad locality. The town of Prome yielded a cholera death-rate of 7·08 per 1,000, while Prome district had a rate of 2·89 per 1,000.

The highest rate of the year was returned from Pantanaw town. This was 3·58 per 1,000, a rate which exceeded that of Irrawaddy division, in which it is situated, by 6·59 per 1,000. Hanthawaddy district, in which the capital, Rangoon, with a population of 134,176, is situated, returned a cholera-rate of 0·45 per 1,000, while Rangoon had a rate of 0·52 per 1,000, in spite of its large population. Apparently the comparative exemption of the city was in part at least due to sanitary work. The general result of the year's experience may be said to be that, during cholera periods, two factors are included, the epidemic over which we have no control, and local insanitary conditions which we can remove or mitigate. It is the same experience which is reproduced in every outbreak of cholera, and it carries its lesson with it.

We shall return to this aspect of the question while discussing the sanitary state of the towns. But in the meantime it should be stated that, out of 20 towns with an aggregate population of 425,775, all returned cholera deaths with two exceptions, Mergui and Toungoo, whose conjoint population was 25,832, so that a town population of about 400,000 yielded 1,139 deaths. On the other hand the country population, which yielded the village deaths, was 3,227,854, living in 14,811 villages, of which 227 only suffered. We have no means of estimating the population of these 227 villages. All we know is that they yielded 4,376 deaths, or about 19 deaths per village.

8. *Small-pox.*—The second disease on the list is small-pox, the deaths from which were 6,012, or above 500 more than the deaths from cholera. Of these small-pox deaths 1,088 took place in children under one year of age, and 4,061 from that age and under 12. Hence there were 5,149 deaths, or about 85 per cent. of the total mortality, at ages when the protection under an efficient system of vaccination ought to have been more or less complete.

9. The past history of small-pox mortality in this province has been as follows since 1872, in which year 845 deaths were registered :—

Years.	Small-pox Deaths.	Years.	Small-pox Deaths.
1873	1,416	1879	2,297
1874	1,191	1880	5,402
1875	752	1881	1,766
1876	1,335	1882	770
1877	1,230	1883	675
1878	1,408	1884	6,102

It will be seen that the largest number of deaths registered was in 1884, and we have just seen how heavily the mortality fell on the younger ages, a sure test of inadequate vaccination arrangements. From data in the Report we learn further that during the last eight years about 65 per cent. of the small-pox mortality had been registered among children under 12 years of age.

10. The monthly deaths in 1884 were as follows :—

Months.	Small-pox Deaths.	Months.	Small-pox Deaths.
January	194	July	561
February	621	August	460
March	794	September	367
April	740	October	272
May	765	November	255
June	714	December	339

This abstract shows the highest mortality from small-pox during the hot months. The epidemic was present in all the districts with one exception, and the affected registration circles (146 out of 343 in the province) were scattered over the districts, except in the exempted one referred to. But the epidemic law was strictly followed, for the entire year's mortality was returned from no more than 149 population groups out of 14,811. All the 20 towns with two exceptions, Tonghoo and Mergui, suffered, but as these two towns are the same two that escaped cholera, the probability is that this apparent exemption was the result of bad registration.

So far as can be estimated from the registered deaths, the epidemic was much more severe in town than in country circles. The towns yielded a very high rate, namely, 4·86 per 1,000, while the country rate was 1·67 per 1,000.

11. As there is defect in the birth registration, we cannot estimate with any degree of accuracy the influence of vaccination on small-pox mortality. Taking the data in the Report as the best available, the births actually registered in 1884 numbered 82,783. But the vaccinations under one year were only 9,673, or fewer than an eighth part of the registered births, which were far below the real number. Between one and six years, there were 35,481 vaccinations, but this number cannot be counted against the actual births. The total successful primary vaccinations at all ages were 69,853, so that including successful re-vaccinations, and while the registered births amounted to 22·66 per 1,000, the successful vaccinations of all kinds and at all ages were 19·95 per 1,000 of the population.

12. The vaccination staff of the year stood as follows :—

Superintendent-General	1
Superintendents of Circles	19
Deputy Superintendents of Circles	1
Native Superintendents	5
Vaccinators :—	
1st class	20
2nd class	38
Servants	3
Total staff	87

The practical result of the year's vaccination work is that great improvements are needed before the infant population can be considered safe from this scourge. The facts are duly estimated in the present Report, and all we can do is to repeat a recommendation we have often made, that the best results of vaccination must be sought, not by increasing the number of operations at the higher ages, but by directing effort mainly to securing the vaccination of infants.

13. *Fevers.*—The following table gives the monthly average fever mortality, together with the monthly average climatic elements for 1884 :—

Months.	Fever Deaths.	Rainfall, Inches.	Humidity.	Mean Temperature.		
				Max.	Min.	Range.
January	2,205	·11	89·86	88·75	61·29	22·66
February	2,125	·29	84·50	87·09	59·81	27·28
March	2,026	·97	86·50	93·10	68·00	25·27
April	1,712	·65	86·57	96·44	72·71	23·73
May	1,794	2·00	87·21	93·27	73·80	19·46
June	1,994	23·43	88·71	88·72	73·80	15·93
July	2,974	36·31	85·50	86·28	73·92	12·36
August	3,184	27·06	85·79	86·00	73·97	12·03
September	3,008	23·11	85·21	85·92	73·71	12·21
October	2,583	7·80	79·14	88·57	72·15	16·42
November	2,736	2·62	73·52	86·45	67·49	18·54
December	3,131	—	64·43	83·59	60·30	23·29

The fever deaths in this table are those registered, but the climatic data appear to have been obtained by adding up the monthly averages and dividing the sum by the number of observing stations. In this way only a rough general estimate of the relation of climate to fever deaths month by month can be arrived at. The facts are relative, but not absolute. They nevertheless show that high daily range exerts a certain influence on the fatality of fever, just as rainfall does.

We have not the means of instituting similar comparisons for each of the districts, but we can place side by side the fever mortality and the rainfall in each division as follows :—

Divisions.	Average Rainfall, 1884.	Fever Deaths per 1,000.
	Inches.	
Arakan	204	12·29
Pegu	78	7·84
Irrawaddy	78	7·86
Tenasserim	147	5·77

But these average rainfalls are made up of large and small amounts, and do not admit of being used as ratios. We may, however, state, as a matter of fact, that in 1884 Akyab district had a rainfall of 196·83 inches and a fever death-rate of 12·69 per 1,000, the highest rate of the year. Thyet Myo had a rainfall of 33·47, and nevertheless its fever rate was 10·21 per 1,000. Take again Tavoy district. It had one of the lowest fever-rates of the year, namely 5·33 per 1,000, and yet its rainfall was 165·72 inches. This occurrence was not accidental, for the mean rainfall of Tavoy for the five previous years had been 210·91 inches, actually the highest five years' average of any district in Burma, while its mean five years' fever-rate had been 4·89, within a small fraction of the lowest district mortality of the same years. These facts throw light on the relation of rainfall to fever. At first sight it would appear that the more rain the more fever was the rule in Burma. But this is really not so, and the causes of fever mortality must be sought elsewhere.

14. There are whole districts of country in which the fever-rate is remarkably low, that is if the registration could be depended on, and it is not improbable that some of the mortality may be due to the usual local insanitary conditions, as well as to malaria. The Report does not help us much at arriving at these conditions. But the town rates averaged 10·33 from fevers and the country rates 7·78 per 1,000, pointing to the presence of fever causes in the towns.

15. *Bowel complaints.*—Deaths registered under this head numbered 3,719. They were all returned from 131 villages, situated in 118 registration circles. It is highly improbable that the registration in this instance affords any data worth discussion.

16. *Injuries and all other causes.*—There were 522 deaths from "injuries," and 23,862 registered under the head of all other causes, so that no account could be given of a third part of the total deaths of the year.

17. *Sanitary condition of the towns.*—Under the head of "Sanitary Works (Civil)," there is a certain amount of information given which enables us to form an estimate of the present sanitary state of the chief population groups. The 20 towns contain a population of 425,775, their average death-rate in 1884 was 36·65 per 1,000 from all causes, or above six per 1,000 over the preceding five years' average. The facts tell against sanitary progress. The five years' rate was 27 per 1,000, a rate exceeded in several of the towns, and which of itself would argue great want of sanitary care. Usually in these Eastern towns progress in improvements is attended by tangible reduction in the death-rates, but in these Burmese towns we have a large increase in 1884. Moreover, registration ought to be more or less reliable in the town circles, so that the evidence apparently leads us to conclude that there has been some falling off in sanitary work.

18. The town death-rate of 36·65 per 1,000 was made up as follows:—

Cholera	2·68	per 1,000
Small-pox	4·86	„
Fever	10·33	„
Bowel complaints	3·48	„
Injuries	0·31	„
All other causes	14·99	„
All causes	36·65	„

Here we have diseases of the so-called zymotic class, yielding a death-rate of 21·35 per 1,000, a rate for which there must be some local reason.

19. Rangoon, the capital, with a population of 134,170, had a death-rate in 1884 of 38·08 per 1,000, against a previous five years' average of 29·87 per 1,000. Of this rate of 1884 only 0·52 was due to cholera. There was a severe epidemic of small-pox, during which 884 of the people died, or 6·59 per 1,000. There were 1,861 deaths, or 13·87 per 1,000, from fevers, and 4·08 from bowel complaints. Part of the excess of mortality was due to small-pox. The cholera mortality, although low, exceeded the Hanthawaddy district rate, which was 0·41 per 1,000.

Rangoon presents a good instance of a town in which the element of impure water has been eliminated. It is stated by the Medical Officer to have been derived as during the last year for the most part from the Kokkaing and Royal lakes, and is "abundant, pure, and delicious." Whence came the cholera death-rate in excess of the surrounding country rate if the sole cause of cholera is bad water? The new water-supply is only one of the improvements which we are glad to see are in progress. The large influx of water has directed attention pointedly to means for its removal from the town site, a measure of absolute necessity, and a drainage scheme besides the existing surface scheme was under consideration. It is described as follows:—"An elaborate scheme for the drainage "of the town on Shone's hydro-pneumatic system has been prepared by the Engineer, and is under "the consideration of the Committee. The estimated prime cost is 170,346*l.*, and if a supplementary "high pressure water-supply is adopted at the same time 180,035*l.*" No details of this proposal are given, and we are unable to deal with it. Drainage of private houses was in progress while surface drains were being extended. Conservancy has been attended to as usual, and 25,000 tons of street sweepings had been deposited and covered on low-lying ground, whereby about 12 acres had been reclaimed, not, as we trust, to be built on. Night-soil to the amount of 42,500 tons from an area occupied by 60,000 persons had also been removed. This is all in the right direction, but the time appears to have arrived for the municipality with the aid of their health officers to inquire into the causes of the existing high death-rates, and in doing this to localize them, for it is more than probable that the town death statistics are unduly raised by the bad sanitary condition of certain areas, and information so obtained would enable sanitary outlay to be more efficiently applied. It would be most advisable that in this far off Eastern city a complete sanitary system should be agreed on after such an inquiry as we have suggested, and the worst districts first taken in hand.

20. *Prome.*—This town has a population of 28,813, and a very high death-rate, no less than 52·82 per 1,000, which exceeded greatly the five years' average of 34·86 per 1,000. Of the high rate of 1884 cholera yielded 7·08 per 1,000, small-pox 3·89, fevers 13·12, and bowel complaints 5·14 per 1,000. Hence the aggregate death-rate from diseases of the epidemic class was no less than 29·23 per 1,000, a ratio considerably in excess of what the death-rate from all causes ought to be in so small a population. Out of 1,522 deaths registered in 1884 no fewer than 842 were due to directly mitigable or preventible diseases; yet of this great loss of life no adequate account as regards its causes is given in the Report. Part of its water-supply is derived from tanks and wells, and is "very impure." The drainage has been improved, but it is expected that when the new scheme is carried out the drainage "will be very perfect." No account, however, is given of the scheme, and we can form no opinion about it. There appear to be cesspits behind the houses, and removal of night-soil by hand, to be afterwards trenched, is in use for household cleansing. When the population, its death-rate, and diseases are compared, it appears as if a careful and detailed inquiry and report were necessary to enable sanitary work to be properly directed in Prome.

21. *Shwedaung* has a population of 12,373, and a persistently high death-rate. Its five years' average was 41·40 per 1,000, which rose in 1884 to 45·10 per 1,000. Its death-rate from cholera was 3·88 per 1,000, from fevers 10·02 per 1,000, and from bowel complaints 9·54 per 1,000. There were only three deaths from small-pox. In this town the water-supply is bad, the drainage appears to be effected by surface cuts, and the cleansing staff, which, nevertheless, consists of 15 coolies and four carts, is considered to be insufficient. It would be advisable in this case to examine into the sanitary state of the houses and their water-supply; with so small a population, it seems not unlikely that the death causes may be local rather than general.

22. *Akyab*, with a population of 33,989, yielded a death-rate in 1884 of 39·34 per 1,000, or about 9¼ per 1,000 over the previous five years' average. There was no small-pox, and above half the year's mortality was caused by cholera, fever, and bowel complaints.

There appears to be something unfavourable to health in the local position of this town, besides defects in its water-supply and drainage. It appears as if the present surface work did not reach the causes of ill-health, while it is not unlikely that the more important evils may be found within the houses and compounds.

23. *Moulmein*, after Rangoon, is the largest town in British Burma, and had a population of 53,107. Its death-rate in 1884 was 32·31 per 1,000, and its previous five years' average rate was 20·92 per 1,000. The zymotic death-rate was 17·39 per 1,000. Moulmein is supplied with water by wells which dry up in the hot weather, and water has to be brought from the Attaran. There is only drainage by surface cuts, and the night conservancy is carried out by contract under inspection, and the night-soil is buried "when possible." Cesspits are also used.

24. These examples will be sufficient to show what is the sanitary state of the towns, and it will be observed that the more obvious disease causes are those connected with the state of the subsoil and wells.

The towns are now under local government, and while no serious objection can be raised against the existing sanitary procedure, it can scarcely be sufficient for removing disease causes. The safest way to lay a reliable foundation for dealing with these is to have the towns carefully examined with the death statistics in hand, to determine what should be done to begin with the worst localities. The facts, so far as they go, account for the epidemic mortality.

25. In the matter of sanitary works there is only little to record.

The whole amount expended for a year's sanitary work was Rs. 1,54,187, allotted as follows:—

	Rs.
Water-supply	84,365
Latrines	4,775
Markets	25,049
Burial grounds	9,498

The two last items, although very necessary in themselves, left no more than about 7,000*l*. for sanitary work properly so called. Of course not much could be done with this outlay. Generally speaking, water sources appear to have been cleansed and repaired, surface drainage cleaned out and extended, and other drainage improvements initiated. Conservancy appears to be the sanitary measure best carried out, but until the house cesspits and bad wells are closed and the public health protected, not by this or that expedient, but by consistent schemes of work carried out under the local authorities, the high epidemic death-rates in towns may be expected to continue.

26. As we have suggested, future sanitary inspections and Government endeavours should take this direction for the towns, so that the new authorities may be kept out of wrong grooves at the beginning of their work, but the towns contain only a small part of the population, and as the Government of India has stated in the 8th paragraph of their letter on this Report, "Nothing seems "to have been done during the year to improve the sanitary condition of the villages in the province, "nor were sanitary works of any magnitude undertaken in the towns, but it is satisfactory to observe "that some important sanitary projects were under consideration."

This passage resumes in a few words the present position of public health proceedings in Burma, and it is very necessary to see that any projected works are found in principle, and suited to the requirements of each locality, while the villages where epidemics have their origin are not neglected.

12th March 1886.

No. 11.

Memorandum of the Army Sanitary Commission on the Sanitary Condition of Rajputana for 1884.

1. The data in this Report consist of two separate groups. Those referring to the population of Ajmere and Merwara, which is stated on the Census of 1881 at 460,722, and those belonging to 16 Native States, the population of which at the same census was returned at 9,354,163.

Sanitary work in the first group is done more or less under the inspection of British officers, and in the Native States any progress may be said to be due to example, persuasion, and to a desire on the part of Native rulers to improve the sanitary condition of their subjects.

For Ajmere and Merwara we have data similar to those returned from other Indian Governments. But for the Native States the returns refer to vaccination and dispensary work and to jail statistics. Properly speaking, there are no sanitary statistics as yet, although the local authorities appear to be doing the best they can to afford information on the subject.

2. The following remarks will be chiefly confined to the sanitary data of Ajmere and Merwara.

As already has been stated, the population of these two provinces amounting in 1881 to 460,722, but the rate of increase is not known.

The population was made up of 57,809 Muhammadans, 400,337 Hindus, no Christians, and 2,576 of other classes. The births registered in 1884 were of males 6,749, of females 5,798, together 12,547, or 27·23 per 1,000 of the population, a ratio under the truth.

3. In the same year the deaths amounted to 5,827 males, and 4,597 females, together 10,424, equal to a death-rate of 22·62 per 1,000, also below the true rate.

4. There are 23 registration circles in the provinces, which yielded death-rates between 13·29 and 45·45 per 1,000. The registration is improving, as is shown by the total rate having increased from a five years' average of 21·84 to 22·62 in 1884, while during the same five years the differences in the circle death-rates were much greater than in the latter year.

5. The death causes of 1884 are enumerated as follows:—

Diseases.	Deaths.	Deaths per 1,000.
Cholera	227	0·49
Small-pox	958	2·06
Fevers	6,428	13·85
Bowel complaints	1,205	2·61
Injuries	207	0·45
All other causes	1,409	3·06
All causes	10,424	22·62

This abstract shows that although cholera prevailed in an epidemic form, its death-rate was the lowest of any disease rate of the year; that small-pox was four-fold more fatal than cholera, but that the chief losses of the year were assigned to fevers, which yielded nearly two-thirds of the mortality.

6. *Cholera.*—This disease appeared as a distinct and completed epidemic in the course of 1884, as is shown by the following monthly mortality:—

Months.	Deaths from Cholera.
May	3
June	5
July	136
August	72
September	11
Total	227

Of the 23 circles of registration, cholera appeared in 11, but its ravages were confined to 15 out of 739 villages in the States. The epidemic was almost confined to the eight circles of the northern or Ajmere division, or perhaps more correctly to Ajmere town, its suburbs, and rural circle. The population of these three localities amounted in 1881 to 71,084. The deaths from cholera were 175, and the death-rates were for Ajmere town 1·45, for the suburbs 12·45, and for the rural circle 0·41 per 1,000. It is quite evident, therefore, that the full force of the epidemic fell on the suburbs of Ajmere, where, out of 8,592 inhabitants, 107 died of cholera.

We shall next abstract the account given of this occurrence.

7. The first case of the Ajmere outbreak took place in a woman lodging in a hut in the suburbs of Ajmere on the 25th May, who had arrived the day before from Aligarh, "where people were "suffering from cholera." (Aligarh district contains a population of 1,021,187, among whom there were three deaths from cholera in February, two in March, one in April, and 52 in May.) There was no other case until 15th June, when two were attacked, followed by four others, near the Delhi and Madar gates of the city. The disease remained quiescent until the 2nd July, when it burst out, and before the end of the month 253 persons were attacked and 114 died. In August there were 84 cases and three deaths.

8. The deaths in towns were as follows:—

Ajmere, 59 in June, July, and August.
Pisangan, 3 in July.
Nasirabad, 8 in August and September.
Nyanagar, 20 in May, July, and August.

The dates show that the epidemic covered nearly the entire area of Ajmere and Merwara, but it also covered the Native States, and the total registered cholera mortality for Rajputana, including Ajmere-Merwara, was as follows:

	Deaths.
May	84
June	145
July	485
August	473
September	107
October	3

The Native States of Central India suffered at the same time, and before those of Rajputana. There were fatal cases there in January, March, and April.

The mortality for the whole group of States in Rajputana and Central India was 2,315. The history is that of an ordinary cholera epidemic having no relation to the disease in Aligarh or anywhere else except an epidemic one.

9. The most important fact connected with the cholera epidemic of 1884 was its severity in Ajmere and its vicinity, especially in the suburbs, and this has been no new experience, although the great cholera death-rate of 1884 points apparently to the danger of severe periodic outbreaks beyond the usual mortality. The rate of 1884, as we have seen, was 12·45 per 1,000, while the previous five years' average rate had been 1·63 per 1,000 for the suburbs, and 1·50 per 1,000 for Ajmere rural circle, or nearly tenfold the quinquennial average for other parts of the provinces. There must, of course, be some reason for this great difference in liability to cholera, but no reason for it is assigned either as regards locality, climate, or sanitary conditions. We have alluded to this point in previous Memoranda, and it may be again suggested whether skilled inquiry may not throw some light on it.

10. We, of course, take it for granted, in the absence of definite information, that the sanitary state of attacked houses and localities does not differ much from those of other groups of Indian population, but when epidemics are more fatal in some districts than in others in the same province it is only reasonable to expect some account of the causes. As regards the Native States, the Surgeon-Major remarks that, "it is not surprising to find that, though individuals here and there dimly "perceive the importance of hygiène, the people generally in the Native States are indifferent to it." It is the same case all over India, and it can only be met by bringing the influence of the first class to bear on the second. In the Native States much might be done by the rulers if their attention was properly directed to the subject.

11. *Small-pox.*—In Ajmere and Merwara there were 948 deaths from small-pox registered, of which 358 were under one year of age. The death-rate was 2·06 per 1,000, or nearly fivefold the death-rate from cholera. The previous five years' average rate was 1·71 per 1,000, or eightfold the corresponding death-rate from cholera.

Cholera in 1884 took the form of an outbreak in the middle of the year, but small-pox deaths were registered in the following monthly numbers:—

Months.	Small-pox Deaths.	Months.	Small-pox Deaths.
January	88	July	61
February	77	August	21
March	178	September	12
April	243	October	11
May	207	November	6
June	66	December	29

It will be observed that the cholera outbreak began when the small-pox epidemic was on the decline. Cholera was reported from 11 registration circles, while small-pox deaths were registered in 21 circles out of a total of 23 in the provinces. There was the same difference in the proportion of population groups attacked. Cholera appeared in 15 towns and villages out of 739, but small-pox covered a tenfold greater area, or 151 population groups. The two diseases, moreover, did not attack the same places with equal intensity. Ajmere, its suburbs and rural circle, which suffered so severely from cholera, yielded only 64 deaths from small-pox; while Binai and Mazada, which escaped cholera altogether, had 337 fatal casts of small-pox. Again, the whole of the south-eastern division, which includes Merwara, returned 20 deaths from cholera, whilst its small-pox mortality was represented by 382 deaths.

So far as the registration can be depended on, the two epidemic diseases had quite distinct histories, without any relations to each other.

12. *Vaccination.*—In Ajmere and Merwara this service was carried out by six vaccinators, and 3,982 persons were successfully vaccinated. An unusual proportion of operations are returned at young ages, for there were 1,976 vaccinations under one year of age, and 1,930 over one year and under six; so that nearly the whole number were young children and infants. The number of registered births in 1884 were 12,547, so that the vaccinations under one year were fewer than a sixth of the births, showing that considerable extension of the vaccination service is required, and mainly in the direction of the infantile ages.

13. *Fevers.*—Endemic diseases registered under this head were by much the most fatal death causes in 1884. All the 23 registration circles in Ajmere and Merwara, and all the villages, 739 in number, with two solitary exceptions, returned fever deaths, numbering in all 6,428, or in the high ratio of 13·95 per 1,000, against a previous five years' average of 11·72 per 1,000.

14. The following were the registered monthly deaths in 1884:—

Months.	Fever Deaths.	Months.	Fever Deaths.
January	452	July	487
February	467	August	603
March	460	September	704
April	378	October	699
May	412	November	761
June	324	December	681

The year's numbers show the disease to have been mainly endemic, with a tendency to increase during the drying-up months of the year. There is no information in the report on fever causes.

15. *Bowel complaints* were returned as death causes from 22 out of 23 registration circles, and from 352 population groups, or nearly half the entire number. The monthly distribution of deaths was nearly the same as in the case of fevers. They were 1,205 in number, or 2·61 per 1,000 of the population, against a previous five years' average of 2·23. The data do not call for remark.

16. Before discussing the present state of sanitary service in the provinces, we shall give a brief account of the disease history of the Native States.

There are 16 Native States in Rajputana, but returns of births and deaths were received from only three States, Jallawar, Burtpore, and Ulwar, and from five cities. The population supplying the data was 1,861,215, out of a total population of 9,354,163.

Registration is only in its infancy in these States, but still a beginning has been made, and, such as they are, the data have been collected and supplied voluntarily by the Native authorities. Births were registered in all the localities with the exception of Ulwar city. They amounted to 26,936 or 14 per 1,000 of the population.

17. The following deaths were returned:—

	Deaths.
Cholera	135
Small-pox	920
Fevers	12,430
Bowel diseases	2,390
Snake-bite	6
Injuries	425
All other causes	4,778
All causes	21,084

The death-rate on the registering population was 11 per 1,000. The highest rate, 39 per 1,000, was returned from Joypore city, which also returned the highest birth-rate, 31 per 1,000, both rates showing good registration work. The lowest death-rate was returned at 3 per 1,000, from Bhurtpore State.

18. There is very little information about the local causes of epidemic diseases in these States, and very little appears to have as yet been done for their removal. Not much, indeed, can be effected at present in the way of improvement, because the facts in vital statistics on which the necessity for improvement must be based can scarcely be said to exist. This circumstance shows the necessity of recognizing the work which has been done in this direction, and encouraging further progress. This, together with the spread of information among the Native authorities, appears to be all that can be done at present.

Vaccination in Native States.—Vaccination is carried out to a considerable extent in all the Native States. In 1884 the work was done by 74 vaccinators, and the *successful* operations returned were as follows:—

Under one year	71,202
One year and under six	52,515
Total at all ages	131,806

This total shows a large increase of operations in 1884 over the previous five years' average, which was 85,135 vaccinations per annum. We have no means of comparing the deaths from small-pox within the area covered by the vaccination, nor of estimating the relation of vaccinations under one year to the year's births.

Jails of Rajputana.—There is a single jail under British supervision in Ajmere, and 13 jails in the Native States, and the following abstract shows the relative sanitary state of each class for the last five years:—

Years.	Adjere Division.		Native States.	
	Number of Prisoners.	Death-rate per 1,000.	Number of Prisoners.	Death-rate per 1,000.
1880	484	10	2,806	48
1881	429	4	2,787	46
1882	495	26	2,662	36
1883	562	11	2,695	33
1884	583	3	3,020	45

If the class of prisoners is the same in Ajmere jail as in the Native jails, it is quite clear that there is much requiring improvement in the latter. The problem may be stated in the following question,

which is intended to lead the Native authorities to inquire into the subject. What is the reason that the death-rate in Native jails is fourfold the rate which has ruled in Ajmere jail? In 1884, 583 prisoners in Ajmere jails yielded two deaths, at a time when out of 3,020 in the Native jails 187 died. No sufficient account had been available as regards the causes of death in Native jails, except that 10 per cent. of them were due to malarial fevers, 17 per cent. to cholera, 20 per cent. to respiratory diseases, and 32 per cent. to diarrhœa and dysentery.

21. The mortality in Ajmere jail was made up of one death from apoplexy, and one from Bright's disease, neither of them jail diseases. The few facts we have been able to give regarding the death causes in Native jails show how large a proportion of the mortality in them was due to jail diseases.

22. *Sanitation.*—We have already quoted the Surgeon-Major's statement about Sanitation in Native States, and we may add to it the following paragraphs from his Report:—"A general, if a "somewhat unequal, advance has been made in sanitation by the Native States. This advance is "shown not only by an increasing interest in the cleanliness of the cities, but also by improvements "effected in jails and dispensaries."

This is well so far as it goes, but we have frequently shown that mere surface cleanliness is no test of sanitary condition. Disease causes are not on street surfaces, but in houses and house compounds.

In Jeypore the adoption of a complete system of conservancy is waiting provision for railway removal of town refuse at present in hand. Latrines and urinals have been erected. In two districts progress has been made in village sanitation.

"In Ulwar, owing to the intelligent interest taken in the subject by His Highness the Maharao Raja, the advance reported in previous years has, it is believed, been fully maintained."

In Jodhpore the conservancy staff has been re-organized, and several cities named are kept clean. This section of the Report is concluded by the remark that, "while therefore an enormous amount "remains to be done, it can be confidently asserted that something has already been effected, and "that progress is being made in the improvement of sanitation in Native States." Under these circumstances, perhaps the best advice we can give would be to place copies of our "Suggestions" in the hands of the authorities.

23. We have already called attention to the great loss of life from cholera in Ajmere and its suburbs as proving the presence of disease causes of intense activity in the latter. The improvements noticed in the present Report appear to extend to the town only. By the beginning of the present year, 1886, it was expected that the arrangements for the removal of town refuse by rail and provision of filtered water would have been completed. The Municipal Committee, it is stated, had "paid "considerable attention to sanitation, but progress is slow."

This may be taken as describing the state of most Indian municipalities, where, after all, the great want is not money, but energetic action.

24. In conclusion, we cannot compare the details given in this Report with those in the Reports of previous years without seeing that some improvements in the sanitary condition of the Rajputana States have been realized. The work is, and apparently will continue to be, carried on with considerable deliberation. But no doubt every encouragement will be given to the local efforts of individual rulers in perfecting their sanitary statistics, and using the information they will afford for saving life. The most unfavourable feature in the Report is the state of Native jails, which might be represented possibly with advantage to the local authorities. But, so far as liability to cholera is concerned, there appears to be plenty of work to do nearer home, in rooting out the epidemic diseases causes in Ajmere and its suburbs.

22nd June 1886.

No. 12.

MEMORANDUM of the ARMY SANITARY COMMISSION on the ADMINISTRATION REPORT of the MADRAS MUNICIPALITY for the 15 months from 1st January 1884 to 31st March 1885.

1. In our Memoranda on previous Reports of the Madras Municipality, we discussed the vital statistics of the population with special reference to the epidemic history of the city, and we were enabled, by the aid of local inquiries conducted by officers of the municipality, to show to what probable causes the high death-rates were due. These causes, indeed, appear to have been fully recognized in Madras itself, for on two separate occasions surveys and plans of works were prepared and submitted to the local authorities, but, apparently on account of the outlay required to give effect to either of them, they were not adopted. It was understood, however, at the time that there was still a hope that the city might be drained when the requisite funds were available.

2. At that date a new and better water-supply was introduced, but the available amount of it is still too limited to supply the whole population with a sufficiency for all domestic purposes, and a large part of the population is still dependent on bad or doubtful wells for their daily wants.

3. There was an active cleansing system in operation, as it still is, but it was and is confined chiefly to surface work, and within the last year or two we have quoted from Madras Reports the reports of medical inspections, showing the condition of house compounds, and the need of extending cleansing operations to them as well as to the streets.

4. The house sewage has been usually collected and removed by hand labour and carts, and this work appears to have been done with considerable efficiency in the divisions to which it has been extended, but the Report states that the fourth, fifth, and eighth divisions, which contain 17 villages, and an aggregate population of 115,388, "are yet without any system of house conservancy."

5. At different times underground sewers have been constructed here and there, chiefly as it appears to relieve localities from flood water, and there are no fewer than 12 sewage farms on which sewage of various kinds is in course of application for agricultural purposes, and a great improvement has been carried out recently in diverting sewage from the Cooum.

6. In default of a proper system of drainage and sewerage, a proposal was made to surface drain Black Town by side impervious drains, at an estimated cost of 85,000*l.*, of which 30,000*l.* has been already expended, so that it would be safe to include this drainage work along with the other sanitary works and measures as having exercised, possibly, some favourable influence on the public health.

7. But, besides these works, a quantity of bad unwholesome house property has been from time to time removed, and its disease causes along with it, and, in addition to these sanitary measures, Madras has a hospital and dispensary service, including a vaccination department, under five inspectors, 20 vaccinators, and eight probationers.

8. Altogether, therefore, Madras presents a not unfavourable amount of work of one kind or another, the object of which has been to diminish the sick and death rate of the population, and as the proceedings have been in operation for some 20 years, it is a not unfair question to ask what has been the result. The question is further justified by the fact that the course of improvement which has been adopted by the Madras municipality for a populous city has been based on principles opposed to those which have been acted on in localities similarly situated elsewhere.

9. In dealing with these questions we shall try to avoid all controversial discussion. The whole subject was fully discussed by us long ago. At present we have simply to deal with the facts, as these are presented by the vital statistics of the present Report. There is, however, a slight preliminary difficulty, arising from a change in the beginning of the statistical year from the 1st of January to the 1st April, which has to be dealt with, and objected to, as being contrary to all statistical rule and to the principles of uniformity in statistical periods everywhere else adopted. The key to the resolutions adopted at the International Statistical Congress of London many years ago was this very uniformity. In making up accounts of work and expenditure, the change is not of so much importance. But it is a cardinal principle in all public health questions that the year for vital statistics should be the calendar year, and not the official year, and the Report under review shows the inconveniences of this very change. Take, for instance, the following examples :—

—	Births per 1,000.	Deaths per 1,000.
Calcutta, 1883 - - -	17·6	30·50
Bombay " " -	18·79	29·12
Madras " - - -	41·20	39·20
Madras, 1884–85 - - -	39·80	49·20

Or take such numbers as these :—

Deaths, 15 months ending 31st March 1885 - - -	24,067
Reduced to 12 months - - - -	19,253·16

Of course, we cannot accept the 15 months' data or the calculated deaths, and we shall, instead abstract the numbers for the 12 months of 1884.

10. We hope, however, that in all future Reports the uniform calendar year may be reverted to, as we believe has been the case in Calcutta, where the official style had been tried. The questions involved are purely scientific in character, and have no relation to official convenience.

11. The population on which the ratios in the Report under review are calculated is that of the census of 1881, which was 398,777. The calculated births on this number were 16,133, and the calculated deaths for the complete year 1884 were 19,253·16, and this, when compared with the registered number of 1883, which was 15,487, shows an increase of 3,766 deaths during the calendar year 1884.

12. The death-rates among children were enormous. Above a third of the entire mortality of the year took place in infants under one year of age, and the deaths under five years were above 10,162, out of a population of 46,088, at the same ages.

13. The next abstract shows the death causes, but these figures include the numbers for 15 months, 1884–85 :—

Diseases.	Deaths.	Deaths per 1,000.
Small-pox	4,074	8·1
Measles	146	0·2
Fevers	4,863	10·7
Dysentery	2,158	4·3
Diarrhœa	1,301	2·5
Cholera	1,358	2·7
Injuries	109	0·1
Other diseases	10,473	20·9
Total	24,482	49·5

In order to keep the disease history in the proper order, however, it will be necessary to deduct under each head the deaths registered during the first three months of 1885, and the table will then stand as follows :—

Diseases.	Total Deaths in 1884.
Small-pox	4,064
Measles	138
Fevers	3,779
Dysentery	1,560
Diarrhœa	1,014
Cholera	1,198
Injuries	82
Other diseases	8,298
All causes	20,123

These figures would give a death-rate from all causes in 1884 on the census population of 1881 of above 5 per cent., and of this great death-rate, in a city which has been professedly under the hands of the improver for nearly a quarter of a century, upwards of 58 per cent. was due to epidemic and endemic diseases.

14. We may further call attention to the fact that the actual registered deaths in 1884 were 20,123, while by the back calculation method they were 19,253·16, or 870 below the truth.

15. It is clear from these data that the sanitary problem in Madras is mainly an epidemic one, while to understand it fully we shall have to carry the epidemic history for a number of years backwards. This is shown in the following abstract :—

Epidemic Diseases.	Total Annual Deaths.		
	1884.	1883.	Previous 10 Years' Average.
Small-pox	4,064	1,957	733·5
Measles	138	188	53·0
Fevers	3,779	3,470	3,229·2
Bowel complaints	2,574	2,264	2,327·9
Cholera	1,198	139	376·0
Epidemic causes	11,743	8,018	9,719·6
All causes	20,123	15,882	15,059·3

The registered facts show distinctly enough that the public health in Madras has been deteriorating, and not improving. The 10 years' ratios in the last column are exclusive of the enormous losses of the famine year, but they bear marks of the famine nevertheless, as these showed themselves in subsequent years. There is no such difficulty in comparing the years 1883 and 1884, and the conclusion is inevitable that the sanitary authorities in Madras have not as yet been able to make any impression on the epidemic susceptibility of the population. After many years of work and great outlay, their city has the most unfavourable health statistics of any large population group in India. This result could only have happened from some mistake in comprehending the nature of the problems to be dealt with, or in the methods employed. It may be safely said that, for a seaside city in India, were the death-rate reduced to half the present rate it would still be too high.

16. High as the present rate is, it differs in different groups of villages which go to make up the city. The lowest death-rate was 28·9 per 1,000 in four villages having a population of 19,010. In

another group of eight villages, with 66,655 inhabitants, the rate was 40·8 per 1,000. In another group of three villages the death-rate was 45·7 per 1,000, over 77,497 people. In other three villages, with 52,443 people, the death-rate was 47·1. In five villages, the population of which was 71,095, the rate was 50·4. In another group of four villages, the rate was 52·2 per 1,000, among 63,344 people. Another group of 37,940 people in six villages yielded a death-rate of 53·7, and another of 10,793 people in three villages had the enormous rate of 55·6 per 1,000.

17. With these facts before us, are we wrong in asking what would be the death-rates if there was no municipal sanitary administration at all, and also where is the proof that any efficient sanitary work has been done hitherto? The facts are so striking and so unlike any similar facts which have been presented by sanitary experience anywhere else, that, with the information before us that Madras has had its water-supply largely improved, and also an extensive cleansing system in operation for years, we must either consider the registration of deaths to be altogether untrustworthy, or that the past public health work has not been based on the true principles of prevention of disease.

18. With the statistical facts before us, it seems scarcely necessary to discuss the statements in the Report about the year's sanitary works, or to return to past controversies on their nature. It will perhaps be better simply to start from the fundamental facts already stated, which show that Madras is perhaps the most unhealthy city in India, and that its great death-rate is made up chiefly of epidemic diseases, which carried off 11,743 of its inhabitants out of a total loss of 20,123 by death. All the year's deaths except 8,380 were due to these diseases.

19. Now, all sanitary procedure which is intended to diminish or abolish liability to any class of diseases must be based on acquired knowledge of their causes, which comes by careful observation and experience. The causes differ according to locality and climate, and according to the manner in which locality is dealt with by the population covering it. Epidemic diseases may appear on mountain ranges or on seaside levels. In either case there must be local causes, but it does not follow that the causes should be the same. India presents examples of both classes of cases, as well as of intermediate ones, and it is one of the commonplaces of sanitary experience that, wherever there is stagnant subsoil water, so that the water table rises near the surface, there epidemics find their victims. It does not matter what other causes may be dealt with. This is the fundamental cause wherever it is present, and it can be added to almost indefinitely by filth being washed into the subsoil by rain or by foul drainage.

20. There is a report of 19 folio pages appended to the Municipal Report, and signed by the Officer of Health, but it throws no light on the local disease causes of Madras during 1884. It scarcely alludes to them, and it concerns itself more with the births and deaths, and what may be called the medical aspect of the facts, than with their causes.

21. Many years ago there was at least one municipal officer who told us what he had seen and learned on this all-important subject, but his facts and conclusions were subsequently denied by others. A year or two ago we inserted a statement showing the condition of the dwellings and compounds of the humbler classes. We adopted it as an instalment towards further knowledge, which was never supplied.

22. The most instructive sanitary fact in the present Report relates to the old controverted question of subsoil water level. Sewers have been laid in connexion with certain drainage operations, and the condition of the subsoil is thus stated:—"This portion of the sewer, from first to last, has "given a great deal of trouble. The soil met with was dark, black, and slushy mud, which "extended from 11 to 16 feet below ground level, while the foundation of the sewer was at the "depth of 13 feet." We know not how far this experience represents the condition of subsoil under the villages, but it seems to be matter for inquiry.

Alongside this statement regarding the subsoil of Madras may be quoted from the Report the following statement from the Executive Engineer of Calcutta, who writes:—"The brick sewers are "built with the very best hard burnt bricks and by hydraulic mortar. The pipe sewers are laid "in concrete, and jointed with a mixture of blue clay and Portland cement. Although the sewers "were not designed specially for that purpose, it is an undoubted fact that the level of the subsoil "water has been very considerably reduced all over the town. The subsoil water gets into the "sewers by an insensible percolation through the walls and joints of the sewers, and the walls of "the numerous manholes and lamp-holes. The proof of it lies,—(1) in the every-day fact that much "more fluid is drawn out of the sewers at the drainage pumping station than is supplied through "the waterworks; (2) in the evidence as to the drier condition of the ground floors of houses than "was formerly the case."

To this statement of the Calcutta Executive Engineer, we may add the following facts from our Memorandum on the Calcutta Report for 1882-83:—Referring to the work done by the sewage pumping engines, we stated that "during a period of 15 months, up to 31st March 1883, there were "raised on an average daily 15,514,836 gallons of sewage to a height of 8·78 feet to be discharged "into the outfall. Now it appears that the total daily water supply, filtered and unfiltered, "amounted at the same time to 9,663,301, hence making no allowance for evaporation, which, "however is an important exit for water, the amount of sewage raised and discharged by pumping "exceeded the total water-supply by 5,851,535 gallons, and to this extent the sewage system of "Calcutta afforded daily relief to the low water-logged site it is built on." Where sewage is pumped a large proportion of subsoil water enters the sewers and is pumped also. This must be beneficial, and should be extended.

23. Indeed, sewer systems may be, and have sometimes been, so constructed as to afford free ingress of subsoil water to the sewer, while the risk of escaping sewage has been provided against. Where the subsoil is wet and has been built over, special drains may be laid as deep as practicable and the water removed by pumping. Sewers in wet subsoils, if water enters to a moderate extent, will work better in a tropical climate than a dry sewer in a dry subsoil. Centrifugal pumps will raise large volumes of water 10 or 15 feet at a very small cost.

So far as this subsoil water question is concerned, Madras supplies one of the best illustrations of its disastrous effects on the public health, while Calcutta has shown what the remedy is, and how to apply it.

We my further contrast the death-rates of the two cities as follows:—

	Death-rates per 1,000.	
	Epidemic Diseases.	Total Deaths.
Madras - - - - -	30	50
Calcutta - - - - -	18·2	30·5

24. It seems unnecessary to pursue the subject further; our object, as already stated, is not controversial. We desire simply to call attention to the facts in order that their importance may be recognized and suitable improvements adopted by the Madras authorities, for the practical result of past experience is that the sanitary improvement of this great city has still to be undertaken.

22nd June 1886.

No. 13.

Memorandum of the Army Sanitary Commission on the Administration Report of Municipal Commissioner of Bombay for 1884–85.

1. In our Memorandum on the Report of 1883 we dealt chiefly with certain facts stated in the Report which had an important bearing on the susceptibility of the population of Bombay to epidemic outbursts of cholera and small-pox, and the general principles which in our view ought to be adopted in dealing with them. We have found nothing in the present Report to call for modification of what we then said on the subject, but in place of resuming the discussion it will, perhaps, be more advantageous to follow our usual course and to take up the sanitary history where we left it, and to see precisely what is the present state of the public health as shown by the statistics and by the various departmental reports included in the present volume.

2. The population element made use of in calculating locality ratios is that of the 1881 Census, which was 773,196. But we think there can be little doubt that the population of a great commercial and manufacturing city such as Bombay now is must have undergone considerable increase since the Census year, and hence that all the local ratios will be found too high for any purposes of comparison. This difficulty, which exists in all populations whose rate of increase year by year has not been determined, is one of the main difficulties in the way of estimating the sanitary condition of Bombay, and there is also reason to believe that the registration itself is incomplete. Our estimate will hence be based not only on the ratios but on the actual numbers on the register, so far as these can be depended upon.

3. *Births.*—The population of 1881 included,—

Males - - - - - -	464,763
Females - - - - - -	308,433
Total - - - -	773,196

In the review of the annual report by the Town Council the population is estimated at a total of 825,839, and the births, including still-born, at 16,148, or 17·72 per 1,000 on this number. Were this ratio correct it would show that only about half the births were registered. Taken on the population of 1881 the birth rate would be about 20·9 per 1,000, far below the true rate, and the conclusion is that the birth registration is quite useless for any purpose of comparison, and no more need be said about it.

4. *Deaths.*—Exclusive of still-born there were registered the following deaths:—

Males - - - -	11,757 = 25·29 per 1,000.
Females - - -	10,785 = 34·96 „
Total - -	22,542

The death-rate estimate on the assumed increase of population was 27·29 per 1,000; but on the Census population the death-rate would be a little over 29 per 1,000; nearer, but below the real death-rate if all the deaths were registered.

5. The deaths registered annually for the last eight years have stood as follows :—

Years.	Registered Deaths.
1877	33,511
1878	26,999
1879	22,527
1880	21,146
1881	21,856
1882	20,468
1883	23,530
1884	22,542

On the assumption that the registration errors have been tolerably constant during these eight years, we learn from the figures that subsequent to the famine year 1877 there had been a steady decline in the deaths, with an increase in 1883 not yet passed away.

6. The chief death causes during 1884 were as follows :—

Diseases.	Deaths.	Ratio per 1,000 of estimated Population.
Fevers	6,880	8·27
Respiratory diseases	3,744	4·53
Phthisis	3,091	3·74
Nervous system diseases	2,422	2·93
Diarrhœa	1,081	1·31
Dysentery	635	·77
Cholera	576	·70
Measles	456	·55
Small-pox	112	·13
All other causes	3,595	4·36
All causes	22,542	27·29

Of the registered mortality, 30·30 per cent was due to fevers. Another 30·30 per cent. was due to diseases of the chest, including consumption; and, classing together the diseases usually denominated as epidemic and endemic, we find that 43 per cent. of the year's deaths was yielded by them. But the more purely epidemic diseases, such as cholera and small-pox, the former of which caused 1,027 deaths in 1883, and the latter 1,461, were represented in 1884 by 576 deaths from cholera and 112 deaths from small-pox. This decline affords no proof that the local causes in 1884 were less intense in the latter than in the former year. The reduction was most probably due to less epidemic activity in 1884, and annual variation is, indeed, one of the characteristics of this class of diseases.

7. The endemic fevers of Bombay yielded an increase of 927 deaths over the fever death-rate of the preceding year.

8. These data include the sanitary elements for Bombay, but it is not sufficient to state them generally in this way. For practical purposes they must be localized, in order to be able to discover and remove their causes. This is shown in the next abstract :—

Localities.	Population, 1881.	Death-rates per 1,000 of Population, 1884.				
		Small-pox.	Cholera.	Fevers.	Phthisis, highest Ratios.	All Causes.
Colaba { Upper	9,867	—	—	2·44	—	33·13
Colaba { Middle and Lower	14,265	·07	·53	7·01	—	20·38
Fort { South	3,515	—	—	3·69	—	9·10
Fort { North	38,828	·05	·38	7·89	—	24·32
Esplanade	13,080	·07	1·91	5·65	—	18·42
Market	29,130	·22	·56	7·46	—	24·62
Mandul	42,351	·28	·35	11·21	—	32·06
Chuckla	37,048	·10	·32	11·14	9·04	40·02
Ummarkhári	54,656	·10	·53	9·62	5·47	33·33
Dongri	33,290	·12	·48	8·47	—	26·79
Phobi Talao	39,409	·13	1·62	9·56	—	33·39
Fanaswadi	23,218	·21	1·11	6·20	—	22·09
Bhuleshwar	38,106	·95	·44	8·24	6·21	30·20
Nal Bazar (Khara Talao)	28,691	·13	·52	10·63	7·31	37·88
Kumbharwada	34,990	·05	·68	8·09	4·40	27·77
Khetwadi	29,436	·03	·91	7·94	—	26·87
Girgam	25,319	·27	1·97	9·55	—	32·86
Chaupati	10,975	·09	2·09	5·46	4·93	29·14
Walkeshwar	11,308	—	·35	3·36	—	14·50
Mahalakshmi	6,232	—	·96	11·87	—	32·25
Mazagon	27,904	·10	·64	6·88	—	24·90
Tarwadi	14,342	·13	·48	6·05	—	33·21

Localities.	Population, 1881.	Death-rates per 1,000 of Population, 1884.				
		Small-pox.	Cholera.	Fevers.	Phthisis, highest Ratios.	All Causes.
2nd Nagpada	15,922	·06	·37	11·48	8·47	39·81
Kamathipura	28,455	·35	·49	12·86	5·62	42·17
Tardeo	20,281	·39	·54	9·51	—	23·81
Byculla	26,842	·14	·44	8·90	—	27·38
1st Nagpada	9,872	—	·32	12·80	—	43·74
Parel	18,560	·10	·43	14·70	—	35·77
Sewri	5,555	+	·72	16·20	—	30·78
Sion	17,287	—	·17	8·38	—	21·69
Mahin	17,309	+	1·79	8·95	—	29·23
Worli	14,621	·40	1·09	10·46	—	26·94

These data are only for a single year, 1884, and would be liable to the usual annual variations if they were assumed as constants; but they nevertheless present facts that can scarcely be accepted as strictly accurate. It would appear as if further inquiry were necessary to introduce required corrections. Take, for example, the column representing the death ratio from phthisis. If the data were correct, we should have to rank consumption among the epidemics of Bombay. The year's ratios are apparently not accidental, because similar ratios are given in the Report for three successive years. It seems not unlikely that careful testing of cases would show that other chest diseases besides pulmonary consumption were included under the general designation of "phthisis," just as other diseases are included under the general head of "fevers." But if the ratios as they stand represent roughly the annual losses from phthisis in the most severely affected districts, they would have to be accepted as representing the existence of houses more crowded, of more unhealthy construction, and worse ventilation than could probably be found in any other city. This subject has for years been discussed by successive Officers of Health, and the necessity of town improvements for opening up the more densely-peopled parts has been fully admitted, and to some extent acted on. But the death statistics show as yet no improvement, and the Acting Officer of Health raises the question in the following passage of his special report:—"Plans for almost every description of insanitary buildings "are submitted. A not unfrequent plan is that of a chawl, three or four rooms deep, with, perhaps, "gullies only three or four feet wide on each side. The centre rooms of such a building have no "direct communication with the external air. They are dark unwholesome dens, into which the light "of day never penetrates, and which of necessity must breed disease and pestilence. This is only one "instance of the many unwholesome description of buildings being erected in Bombay."

He fully admits that the setting back of houses to widen streets is an "unmixed good" so far as the street is concerned, but in the absence of necessary Building Acts "by a large expenditure of "money on the one hand certain sanitary advantages are procured, which are in a measure counter-"balanced by defective legislation on the other."

10. He describes the proceedings as follows:—"A man intends to rebuild his house, in the rear of "which ten or twelve feet of open space had been left for ventilation. On submitting plans he is "perhaps called upon by the municipality to set back his house ten feet. What is the consequence? "He does not diminish the size of the house and still leave an open breathing space in the rear, of "ten feet; he literally sets back his house ten feet, and builds on the open space which had originally "been left for ventilation, thus shutting out light and air from the rear portion of the dwelling, and "rendering the back rooms dark unwholesome dens, into which light and pure air never enter." And he concludes, that "it is not only useless but detrimental to enlarge the breathing space of the "streets at the expense of the ventilation of the houses."

But on this view the Municipal Commissioner remarks that "there is no reason in Bombay, more "than elsewhere, that one improvement should be made at the expense of another."

It will be seen that the complaint of the Officer of Health is that nevertheless this is done. We may recall, in passing, that one of the most effectual measures for arresting epidemic diseases in Bombay used to be unroofing affected dwellings, a fact which proves the truth of the Officer of Health's view in another way.

11. The question raised by the preceding table is, whether the haphazard method of massing houses together described by the Officer of Health has been a possible factor in causing the enormous losses from phthisis which have taken place in the city; and the reply must be that just in proportion as original construction or subsequent rebuilding of dwellings has left the all-important requirement in a warm climate of free moving air not only around but inside dwellings unprovided for, will the usually crowded population of unhealthy localities suffer from phthisis and also from endemic diseases generally.

12. The practical result of this discussion is that the widening of streets in such a city as Bombay is of a very decided public advantage, but that it would be less costly and more effective at the same time to reconstruct the removed houses on strictly sanitary principles. Because, if this be not done at the time, it will, in all probability, have to be done afterwards at the public expense, while in the meantime the advantages to health which have been expected from widening the streets will have been only very partially realized, if realized at all.

13. A further examination of the preceding table shows that in nearly all the districts where phthisis is most fatal there are high death-rates from fever, which is a true endemic disease in

Bombay. A probable cause common to both diseases is very probably subsoil damp from defective drainage, for this is a well known cause, where it exists, both of fever and consumption, and it may be safely stated that stagnant, damp, impure air supplies a not unimportant factor in the entiology of both diseases in this city.

14. It will be learned from the table also that all the death-rates vary largely in the different localities. A similar distribution of ratios takes place in all large cities, and is adopted as an index of relative sanitary or insanitary condition, and as showing where outlay for works is required, and the probable nature and extent of them in each locality. In the present case the facts appear to show that there are circumscribed districts in Bombay were general sanitary improvements are greatly needed, and that these are probably subsoil drainage and opening up of closed neighbourhoods.

Mortality from cholera, although influenced by the same local conditions, is more closely connected with filth in air, earth, or water, and thus the table supports the conclusion that the healthiest town will always be that one where sanitary work in all its departments is most fully carried out.

So far as regards phthisis, we concur in the view expressed by the sanitary officer, who says, "unless we are enabled to deal with house sanitation in a more effectual manner than at present, I "fear there is little hope of reducing the death-rate from phthisis."

15. The Report contains no detailed account of the localities where epidemics prevailed in 1884, but in former Reports much useful information has been given about them.

16. As regards cholera, the Officer of Health has continued the details of the relation of this disease to the water-supply, which it may be well to give here simply as facts corrective of opinions still prevalent in certain parts of India that this disease is specially related to cholera-poisoned water.

The 576 cholera deaths which were registered in Bombay in 1884 were related to the quality of water used by the people as follows:—

	Attacked.	Died.
Vehar and Tulsi water drinkers	569	441
Well-water drinkers	89	71
Not known	76	61
Total	734	576

It thus appears that the population using the comparatively pure water conducted in pipes from the country reservoirs yielded 60 per cent. of the cholera attacks, and 77 per cent. of the deaths, while the population still using the bad well water containing foul subsoil drainage yielded about 12 per cent. of the attacks and 12·3 per cent. of the deaths. Although we have no means in either case of giving the ratios to the population using each class of waters, the facts are conclusive as against the specific action of well waters in cholera. They do not prove that bad water has no effect on cholera mortality, but rather the reverse. One result is obvious enough, and this is, that the Vehar water drinkers were affected by localising causes of cholera quite apart from the water-supply. This point is one of considerable importance in sanitary practice, because the facts clearly show that when the well-water drinkers are supplied by the Vehar and Tulsi water mains, which they will be before long, they will still suffer from cholera, and their case will be hopeless unless the real localising causes are dealt with, and what these are is quite well known.

17. We have so frequently discussed the disease history of Bombay that it is unnecessary to enter further on this subject at present, and it will perhaps be better to inquire generally into the present state of the sanitary works, beginning with the following remark in the Municipal Commissioner's Report. After stating that the more important disease causes are, it is hoped, about to be met by legislative remedies, he says, "In these cases the difficulty consists, not in detecting the blot, for that "is patent, but in providing a remedy which shall at once be effective and inflict the least possible "hardship. We have to deal with insanitary habits of very ancient standing, which the great body "of the population regard as perfectly innocent. In the carrying out of many of the most important "sanitary reforms we have to encounter opposition not merely from the ignorant, but from a large "population of the educated classes, and hasty or ill advised action would stimulate that opposition "to an extent which would render all action impossible." We must not forget, however, that similar language might have been used not long ago regarding the opposition to sanitary reforms in many English towns. It follows that the spread of information on the subject is of essential importance. This, to a large extent, ought to be effected by the ordinary municipal discussions and the press. But then it must never be forgotten that the most entire acquiescence of public opinion, say on the necessity of cleanliness, could not in a large city lead to any satisfactory result unless facilities for cleanliness were brought to the houses, and this is not domestic but municipal work.

18. The simple inspection of a cholera locality such as those described by Drs. Klein and Gibbes in their report to the India Office, and then raising the question who is to blame for this, the municipality or the people, ought to lead at once to a practical answer.

19. In such localities the measures required are mainly those which the people cannot apply, such as water-supply, drainage, and cleansing, and which are clearly municipal work. So far as relates to the sanitary state of the houses it would be in vain to look for improvement in this requisite of health so long as the external conditions remain such as have been described in the report referred to.

20. In his own Report the Municipal Commissioner states that house drainage connexions with the sewers are under trial in Kamathipura, and we have referred to this circumstance for the purpose of suggesting, if necessary, that all such trial works require continuous skilled inspection to avoid failure in some small and easily remediable matter which may involve the fate of the entire scheme.

We have introduced these remarks because they refer to matters of sanitary principle, but we are desirous that they should not be understood as implying that good work has not been done for improving the public health.

21. *Water-supply.*—On the contrary, a glance at the tables in the Report shows that, in drainage and water-supply especially, large advances have taken place in the course of the year. In times past there has no doubt been some miscalculation in the amount of water required, so that beginning with the Vehar reservoir, which was soon found to be insufficient for its object, another large reservoir at Tulsi has been constructed, and now it has been decided to add the Tansa scheme to the others, and it is to be hoped that the water-supply will in time be placed on a satisfactory footing, including filtration of the supply. The Bhundarwada waterworks for purifying and regulating the distribution of water had been completed, and had been found to be advantageous in regulating the supply and rendering it more uniform. But it has shown that 12 millions of gallons per diem will be required to meet the wants of the Vehar supplied districts, an amount in excess of what may be available. There was still considerable waste, but 250,000 gallons of waste per diem had been discovered and checked in the course of the year. The tank and filter works on Malabar hill appear also to be near completion.

22. We feel disposed to ask whether so large a number of bursts in water mains and consequent loss as shown in the following list are inevitable:—

Size of the Mains.	Number of Bursts.
48 inches	1
24 „	4
9 „	1
7 „	2
6 „	4
5 „	6
4 „	30
3 „	77
Total	125

23. In former Memoranda we gave the rainfall over the gathering area for Vehar, and the following table will show what has been the rainfall for both the areas at present yielding water:—

Years.	Rainfall, Inches.	
	Vehar.	Tulsi.
1880	72·42	93·76
1881	59·10	86·11
1882–83	54·63	74·22
1883–84	99·54	109·46

For the year 1884 itself the Vehar rainfall was 87·65 inches, and that over Tulsi was 94·84 inches. The facts show how unsafe it would be to depend on a single year's record for the amount of water available.

24. As regards distribution, the house connexions have been as follows:—

1880	12,494
1881	12,817
1882–83	13,244
1883–84	13,545
1884–85	13,909

The public water distribution is effected by,—

46 dipping wells.
56 drinking fountains.
24 stand pipes.
14 large ornamental fountains.
17 cattle troughs.

"All the dipping wells, drinking fountains, &c., were cleaned at short intervals." Better that there were no dipping wells to clean.

There were 715 private water meters and 102 Government meters in use.

25. *Drainage and sewerage.*—Perhaps the most important statement under this head is as follows:—"The discharge of the night-soil that used to be pumped into the harbour at Carnac "Bundar into the new main sewer at the same place is one of the chief features of the year's "administration."

The total quantity of sewage lifted during the year at the Love Grove pumping station was 415,914,598 cubic feet.

The pipe sewers of the first sanctioned portion of the drainage scheme have been completed, but the engineer states that "for want of connexions to conduct the sewage into the pipe sewers they are "doing scarcely any duty. Only in a few cases of new buildings, and of some old connexions (with "the old drains), which are irreparably bad, connexions have been made with the new pipe sewers "at the expense of the house owners."

26. Besides the general advance of the sewerage scheme, much good work for improving the surface drainage and regulating the overflow of storm water, and surface levelling, was done in the course of the year. But notwithstanding all that has been done we are still met by the fact that, while the current mortality from cholera has been greatly reduced, the people are still liable to outbursts of epidemics such as the one described in our Memorandum on last year's Report. Many conditions no doubt act together in leading to this result, but the one which all past experience shows to be the most fatal is defective cleanliness, and the evidence in our possession shows that this disease cause is present in all epidemic localities in the city. We have, in fact, to deal with a case, not of a village, but of a great city of some 800,000 inhabitants, the entire sewage of which has to be collected by hand labour and carried away, while this work must reach effectually not only the streets and better class of houses, but those closely packed, densely peopled localities where most of the people find house room.

27. *Cleansing.*—During the year 1884 there were employed in this work a daily average of 3,603 men and women, including those employed on surface work, and 540 carts, besides 127 used for collecting the night-soil. The staff collected and removed as an every day's average 389 tons of garbage and 295 tons of night-soil.

The total cost of this department of public health work was 83,955*l.*, of which 48,808*l.* was paid for by the Municipality, and the remainder was recouped to the Health Department apparently for work done. Any way, the larger sum shows the cost of this method of dealing with the question to the city. The amount included the cost of clearing out 197 miles of covered drains, which is a customary item in Bombay municipal work. Under any system efficient surface cleansing of all streets, lanes, compounds of houses, and other close localities is of course necessary, but it is not from ordinary street refuse that the danger comes. It is from the solid and liquid sewage of houses, and the filthy state of surroundings which this leads to, that the great losses of life from recurring epidemics arise.

28. It has been a long settled conclusion of sanitary science and experience that, in large cities at least, no attainable perfection in house cleansing can meet the every day dangers to which the people are exposed from disease emanations proceeding from their own excretions. But it has also been a long established result of sanitary engineering that the danger may be entirely avoided by applying natural laws in solving the problem. It can be effectually done by house drainage and water-supply, but in no other way. In a question such as this, where long established unhealthy popular habits have to be set aside, the real point requiring discussion is not whether the people prefer their bad habits to freedom from epidemics, but whether freedom from epidemics is or is not a public advantage. If it is, the discussion is ended, but, of course, in administrative matters of this kind, while the great leading truths must ever be kept in mind and their application in view, much wisdom is everywhere required in giving effect to them. It has happened in this country that loud objections against sanitary works for houses already executed have been at once destroyed by proposing to the objectors that the works should be removed, and things restored to their former state. Even in India trials of house drainage works have been conceded by their owners as a favour to the authority, while they have been at once adopted as soon as their great advantages had been experienced.

29. In conclusion, the Report under review shows that, in the important requirements of drainage and water-supply, advances have taken place in the course of the year, but there is ample evidence to show what a great amount of work in both directions requires to be done before the public health is out of danger, and of this fact perhaps the best evidence is that of the Municipal Commissioner himself, who "expresses a hope that the combination of a copious water-supply with efficient "drainage will lay the foundation of a permanent improvement in the public health of these "insanitary portions of the city; that in six years the Tansa scheme will have given the water-"supply, and that in less than that period the drainage will have been completed;" and he adds this important caution, which we have frequently given in past years,—"the admission of more water "necessitates the construction of more channels to remove it, in other words progress in drainage "operations." The two works in sanitary practice are inseparable. They are indeed one work, and their final object is to supply every person with water for domestic use, and to ensure continuous house cleansing and removal of sewage by gravitation to a distance. Any way this is the position of the works after about a quarter of a century of discussion and consideration of plans, and there are six years still to wait for their completion. In the meantime, all that can be done is to insist on the effective supervision of house construction and on great improvements in the arrangements for cleansing and keeping clean. The state of things revealed by Drs. Klein and Gibbes, and by the Officer of Health, ought no longer to be tolerated, and has not the Sanitary Commissioner for Bombay, who was for many years Officer of Health for the city, told us lately that Bombay is still an "Augean stable?"

25th June 1886

No. 14.

MEMORANDUM of the ARMY SANITARY COMMISSION on the following Papers :—

1. Sanitary Report of Madras Army, 1884, by Surgeon-General J. Irvine, M.D.
2. Remarks on the above by the Commander-in-Chief, Madras.
3. Report on Enteric Fever in the Madras European Army, 1884, by Surgeon-General J. Irvine, M.D.

These papers are separate references, but we shall include our remarks on them in one Memorandum. There is a separate paper by Surgeon-General Dr. Irvine, "Sanitary Report of British Troops in the Madras Command for 1884," which we shall also include, because all of them refer to the same subject.

1. The average strength of non-commissioned officers and men in the Madras European Army in 1884 was 10,812, as given by the Surgeon-General. But the average strength given by Dr. Stephen in his statistical tables differs slightly from the Surgeon-General's estimate; it is 10,785. The difference is so slight that we shall adopt that given in the Madras report. The year's facts will, therefore, stand as follows :—

		Ratio per 1,000.
Average strength	10,812	
Admissions to hospital	11,960	1,106·18
Total deaths	93	8·60
Invalids sent home	350	32·37
Average daily sick	639·49	57·5

Dr. Stephen's returns differ from the Surgeon-General's in giving 92 deaths instead of 93, and he states the average daily sick at 620. The two returns, therefore, differ from each other somewhat, but not to any material extent.

2. The really important points are given in this abstract which shows satisfactory progress in Army health.

	1874–83.	1884.
Admissions per 1,000	1,173·37	1,106·18
Deaths ditto	13·98	8·60
Invalids ditto	40·10	32·37

As we shall presently see, there are disease and death causes still in existence which ought to be abolished, but the results of the 1884 statistics show a very substantial gain to Army efficiency in all its elements.

3. As usually happens, the admission-rates vary considerably at different stations and in different years, but some of the stations have persistently high admission-rates.

Kamptee, for example, showed a ten years' average admission-rate of 1,460·27 per 1,000, and in 1884 the rate was 1,377·92 per 1,000. There must, of course, be some cause for this, and that it has something to do with locality appears to be shown by the fact that of the high rate of 1884 there was due to fevers 587·2 per 1,000, to dysentary and diarrhœa 55·3 per 1,000. Bangalore had a ten years' admission-rate of 1,145·81 per 1,000, and in 1884 of 1,006·48 per 1,000. In the same way Secunderabad, with a ten years' admission-rate of 1,145·81 per 1,000, yielded a rate in 1884 of 1,077·53. These cases have an important bearing on the question of Army efficiency, because of the number of troops stationed in the localities, although the admission-rates are not all due to local diseases.

4. The admission-rate for the whole Madras Army in 1884 was, as has been already stated 1,106·18 per 1,000; of this ratio 242·70 was due to venereal diseases, leaving for all other admissions a rate of 863·48 per 1,000. In the same way, of the Kamptee rate of 1,377·92, the venereal rate was 242 per 1,000; of the Bangalore rate 343·2 and of the Secunderabad rate 234·5 were due to syphilitic diseases.

5. Of mitigable or preventable fatal diseases, the most important were enteric fever, which yielded 129 admissions and 18 deaths, and cholera, for which 12 were admitted, and 10 of them died. The most fatal disease of the year was, however, hepatitis, to which 22 deaths were referred, and there were 9 deaths from apoplexy. There were 12 deaths out of hospital, to be deducted from the 93, which leaves 81 deaths, 59 of which were due to these four diseases.

6. The death causes of the year were as follow, including the above :—

Diseases.	Deaths.	Diseases.	Deaths.
Cholera	10	Hepatitis	22
Small-pox	1	Respiratory diseases	1
Enteric fever	18	Heart disease	1
Apoplexy	9	Phthisis pulmonalis	3
Delirium tremens	1	Wounds, &c.	1
Dysentery	4	All other causes	7
Diarrhœa	2	Deaths out of hospital	12

Taking the more important death-causes in order, we find that of the 10 cholera deaths 3 took place at Madras, 1 at St. Thomas' Mount, 1 at Poonamallee Depôt, 3 at Bangalore, 1 at Secunderadad, and 1 at Kamptee. Out of 12 cases of cholera in the Madras Army 10 died.

7. In connexion with these cholera deaths, it should be remembered that there were 75,476 deaths from the disease among the civil population at the same time. There was a severe epidemic in the Presidency, during which the Native Army had a cholera death-rate of 1·46 per 1,000, while the rate in the European Army was 0·92 per 1,000, both of which may be favourably contrasted with the rate of 2·7 per 1,000 which ruled among the civil population.

8. *Enteric Fever.*—As already has been stated, there were 18 deaths entered under this head in 1884, which was the mortality in 129 cases of enteric fever, and we shall first show the relation which this fever has borne in time past to the general fever history of the Madras Army. Assuming the strength in round numbers at 16,000, the admissions and deaths for 11 years have been as follow from all fevers:—

Fever Types.	1884.		Total in Ten Years 1874 to 1883.	
	Admitted.	Died.	Admitted.	Died.
Enteric fever	129	18	367	145
Simple continued fever	284	1	6,996	33
Febricula	626	—	4,607	
Remittent fever	104	—	907	28
Ague	762	—	14,594	1
Total	1,905	19	27,241	204

The average admission-rate from all fevers was for the ten years 253·33, and for 1884 it was 176·39 per 1,000. The corresponding death-rates were for ten years 1·88, and for 1884 1·76 per 1,000.

9. Of late years the nomenclature of this fever has been unsettled, on account of discussions on the subject of diagnosis of fever cases. This is well shown in the preceding table, and in the following abstract prepared by the Surgeon-General:—

Years.	Ratios per 1,000.		
	Admissions.	Deaths.	Deaths to treated.
1880	2·43	1·07	440·
1881	·86	·48	416·66
1882	4·34	2·12	479·47
1883	8·86	2·73	298·97
1884	11·94	1·67	134·38

This table shows that the diagnosis was unsettled, and it seems doubtful if all the cases entered under the head in 1884 were due to developed enteric fever. But it is also known that the mortality due to this fever does vary in particular years, and the Surgeon-General accepts the diagnosis. Hence, if we agree with his view on this point, we must adopt the consequence which follows from it, that of late years enteric fever has become a more prevalent disease in the Madras European Army.

10. We shall next show where the disease occurred, and we shall place together in the same table the admissions and deaths from cholera:—

Stations.	Enteric Fever.		Cholera.	
	Admissions.	Deaths.	Admissions.	Deaths.
St. Thomas' Mount	1	1	1	1
Cannanore	4	1	—	—
Malapuram	1	1	—	—
Bangalore	60	1	3	3
Bellary	3	1	—	—
Wellington	1	—	—	—
Secunderabad	39	10	2	1
Kamptee	25	8	1	1
Thyet Myo	1	—	—	—
Port Blair	3	—	—	—
Madras	—	1	3	3
Poonamalee	—	—	1	1

There was a case of enteric fever among troops on march, which recovered. On looking at the data in this table, it seems very doubtful if the 60 enteric fever cases at Bangalore, of which 59 recovered, were really due to this fever. One thing, however, must be admitted, and this is that there were 60 fever cases of so severe a character as to take rank with the most fatal of Indian fevers in the estimation of medical officers who treated them. But as the question is a very grave one, it may be suggested whether medical officers in their reports might not with advantage define what they mean by enteric fever, so as to avoid confusion so far as it may be possible to do so. If we accept the data thus far as they stand, we shall have the conclusion forced upon us that, out of 168 station fever cases, of which 18 died, 114 cases and 14 deaths took place at three stations, Bangalore, Secunderabad, and Kamptee, while at the same three stations there occurred seven cases and five deaths from cholera out of a total of 12 cases and 10 deaths in the Madras Army.

11. It is hence clear that in the present much improved sanitary state of the Madras Army there are nevertheless certain stations where there is preventable disease, and these are the stations where, in conformity with sanitary economics, a further reduction in the sick and death rates ought first to be sought.

12. The chief sanitary defects at these stations have been so long known that it seems almost unnecessary repetition to refer to them, but as they form part of the Surgeon-General's Report we may restate them. He says:—"Enteric fever has increased steadily during the last four years, "the increase being most marked in Bangalore, where the water-supply is always bad, and where it "was scanty as well as bad in 1884. It seems probable, therefore, that the quality of the water has "something to do with the spread of this disease. At Bangalore the barracks are all in good "sanitary condition, but some of them are, as stated in last year's Report, too close to densely "populated quarters which are under municipal authorities, and about the sanitation of which "frequent complaints are made."

The remark made by the Adjutant-General on the water question is very much the same as has presented itself year after year, namely, that "the question of improving the water-supply for the "troops at Bangalore, by abandoning the Ulsoor tank as a source of supply, is under consideration "of Government."

This tank was condemned a quarter of a century ago, and even then it had been shown for years to have been a probable disease cause.

13. In last year's Report on the Madras Army one medical officer referred to the probable influence of malaria proceeding from the drying up of the edges of the tank in summer on the amount of fever among the troops, and in the present Report the Surgeon-General tells us that the water-supply was "scanty as well as bad," and this fact implies concentration of all the water impurities under evaporation and absence of rain. We have thus to deal with a quite unsafe water-source which, as has been long known, receives its supply from a foul gathering surface, is liable to pollution from influx of foul drainage at Bangalore, its soluble impurities being liable to concentration by drying up, and the margins in all probability yielding unwholesome emanations at the same time. But, besides the dangers resulting from drying up of the tank, a fall of rain may increase the amount of filth in the water, for Surgeon-General Madden states that 22 cases of enteric fever, out of 30, admitted to the North Station Hospital occurred in July and August, when much impurity was washed by the monsoon rains into the Ulsoor tank, while organic decomposition was rapid and offensive in all low-lying localities.

14. We are glad to learn that the whole subject of the water-supply of troops has been under consideration, and that several projects have been brought forward, but we should be glad to learn within what time the Ulsoor tank and its surroundings are to be finally abolished.

15. But the Surgeon-General's brief remarks raise other very important questions. The civil population of Bangalore is that of a large city, and we are told in the present year's Report that "frequent complaints" have been made about the manner in which the municipal authorities perform "their sanitary duties in parts near the barracks."

16. In the present Report it is also remarked that "the discharge of the filth from the main "drain of Richmond town and Shoolay, within 200 yards of the old Lancers' riding school, had "probably something to do with the prevalence of the disease amongst the men of the 12th Lancers." As there are executive authorities on the spot, it would, of course, be advisable that they should do their work. But what if they neglect to do it? Are the troops to suffer on this account? And would it not be better to make such changes in the law or practice as would ensure that the part of this town near the barracks should be kept clean, and otherwise in good sanitary condition?

17. The following statement by the Surgeon-General regarding Secunderabad throws some light at least on febrile disease causes there. He says, "The main defects at Secunderabad are the want of "trees to check the force of the monsoon winds, and of surface drains to carry off the rain-water. At "present this water percolates into the soil and foundation of the buildings."

Where foundations are raised above the ground level with free perflation of air between the ground surface and the barrack floor, this defect of the subsoil is of less importance, but where the floors are laid without air spaces in malarial climates fever is a necessary result. But wet cultivation, with night-soil as a manure, is still carried on at no great distance from the barracks. As regards surface drainage, the Adjutant-General states that the cost of a complete system is prohibitive. But, in the meantime, it may be suggested whether raising the floors of the barracks in the way suggested would not remove much of the evil.

18. We are glad to learn from the Adjutant-General's letter that a scheme for the drainage of Secunderabad town is now under consideration. No complaint appears to have been made about the water-supply of troops at this station, so that the local causes of fever appear to be those connected with damp malaria producing subsoil under and around barracks, and probably emanations from wet sewage culture.

19. In this and indeed in all cases probably the effect of foul unhealthy bazaars and houses visited by the troops must not be overlooked. The subject is dwelt on by medical officers at stations, and the remedy is a long known one, namely, keeping the outskirts of stations free from disease causes.

20. The 15 cases and three deaths from enteric fever at Kamptee have led to the following expression of opinion as to the cause by the Surgeon-Major :—"In my opinion the *probable* cause of "the disease is the *latrines*. The men will not carry out the dry-earth system properly. I have "constantly noticed a fœcal smell in the neighbourhood of these buildings. All the cases of enteric fever were admitted to hospital during the rainy season, when there is a very damp and close con- "dition of the atmosphere, which produces rapid putrefaction and fermentation. The latrines are "cleared out morning and evening, and I think it very probable that a man visiting the latrines early "in the morning before the pans are cleared out would run the risk of contracting enteric fever." The large amount of enteric fever at Lucknow had previously been attributed to this state of the latrines as a probable cause by the Deputy Surgeon-General.

21. It is an old sanitary proverb that "all smell indicates disease and loss of money." Where badly managed latrines and filth are the causes of smell, the first part of the proverb will always hold good, and the second also if the profitable application of manure be neglected. We have here instances of two stations having latrines on what is called the dry-earth system, while it is not so. Sewage emanations are the result, and we may rest assured that these are active as disease causes beyond the limits of perceptible odour, and then we have enteric fever among the troops; and as to the remedy the Adjutant-General states that additional sweepers are required to go round and put dry earth in the pans after use by the men. We have had the subject so often before us that it seems scarcely necessary to restate the principles involved in the dry-earth system, but the practical remedy suggested by the Adjutant-General is the only one unless a suitable mechanism be provided in each seat. We may, however, repeat what has been said year after year since the report of the Royal Commission, that in such climates as exist in India there is no safety where there is sewage odour. This and not the occurrence of enteric fever cases is the real mark of danger, and whoever is charged with sanitary inspecting work should report on it again and again until the evil is dealt with.

22. The only other disease requiring notice is hepatitis, the mortality from which is differently stated in the reports and in Dr. Stephen's statistics. We have adopted the number of 22 deaths given in the statistics as the finally corrected one. Of these 22 deaths it is important to remark that 9 took place at Secunderabad; but we have no recent account of the causes.

23. The account given of the general sanitary condition of stations does not call for remark, as there seems every disposition to render the barracks and stations healthy, and indeed the low death and in efficiency rates of 1884 show how much good work has been done. There are, nevertheless, exceptional cases where sanitary improvement is needed, and we shall confine our recommendations to these.

1st. The proposed new water-supply for Bangalore should be pressed forward as quickly as possible, and authority should be brought to bear on the municipality to make them keep all that part of the town nearest the barracks in the best practicable sanitary condition.

2nd. It cannot be said that Secunderabad is as healthy as it ought to be. What appears to be required is the town drainage, regulation of wet culture, and in some way protecting ground floors from sub-soil damp. Probably partial subsoil drainage around the barracks would be of use, or raising the floors. We would further suggest that some account of the reasons why so many men die there of liver disease should be forthcoming. Tree planting, if carried out so as not to interfere with ventilation, would, no doubt, be an advantage.

3rd. As regards the latrine details at Kamptee, the remedy is obvious, but we must say that neither at Kamptee nor anywhere else ought such a state of latrine accommodation to be permitted.

8th June 1886.

No. 15.

Memorandum of the Army Sanitary Commission on the Medical History of the European Troops in the Bombay Command for 1884.

During the trooping season 1884–85 there were eleven outward voyages made by the usual transports. The first arrived at Bombay was that of the "Malabar" on the 10th October 1884; the latest, the "Jumna," arrived on 8th April 1885. In the course of the season there were landed at Bombay 639 officers, 126 ladies, and 134 children. Of troops in health there were 11,876 men, 402 women, and 553 children, besides 32 female servants, and there were also 20 horses,

2. In the course of these eleven voyages there were 906 admissions to hospital and 5 deaths. Among the admissions were included 237 cases of primary syphilis, 15 of secondary syphilis, 181 of gonorrhœa, and 15 cases of its sequelæ, making in all 548 from venereal diseases, or 60 per cent. of the admissions from all causes. There were 68 cases of itch, and 25 cases of pneumonia. The 5 deaths were due to rheumatism, sunstroke, heart disease, pneumonia, and injury. There were 15 admissions among officers, including a dislocation from a fall down a hatchway. From among the 402 women there were 35 admissions, and one death from congestive measles. The 553 children yielded 47 admissions and 3 deaths from convulsions, tabes mesenterica, and debility.

3. The sanitary state of the vessels was reported as "very satisfactory." This opinion appears to have been fully sustained by the results of the voyages, except in those cases with which the ships had nothing to do, namely, the venereal and itch cases, which are as great a trouble as ever, and are apparently without remedy. This matter, however, belongs to the administrative rather than to the sanitary department.

4. It is satisfactory to see that out of 639 officers and 11,876 men, 419 officers and 7,879 men arrived at Bombay before the end of the cold season.

5. The return voyages with invalids and time-expired men were effected by 12 troopship voyages and one hired transport. The earliest voyage commenced at Bombay on 28th August 1884, and the latest ship left Bombay on 16th April 1885. During the intervening period there left Bombay for England 428 officers, 162 ladies, and 204 children. Of troops in health there were 6,580 men, 343 women, and 763 children. Of invalids there were 1,407 men, 144 women, and 327 children. There were 62 insanes, 113 convicts and bad characters, and 21 horses. Assuming the duration of the home voyages at one month, 744 invalids, or about half the number, would arrive in England during spring and early summer.

6. *European Army of Bombay.*—We shall next discuss the year's sanitary history of troops at Bombay stations, but there are certain points connected with it which require to be kept in view in order to avoid the formation of erroneous estimates regarding the health of stations, and the steps necessary to be taken for their improvement. Of late years there has been a gradual advance in sanitary work, and a consequent reduction in the death-rates at the older stations, and it appears reasonable that this part of the question should be kept distinct from the effect on health of field service, or of the occupation of stations beyond the influence of improvements already effected. Although in the present report the health statistics of the Bombay Army are dealt with as a whole, the Surgeon-General has very properly discussed certain increments in disease and death-rates during 1884, with reference to special local and climatic conditions at the comparatively new station of Quetta, which furnished them; and we propose to follow the same course, and to deal with Quetta by itself, because it is quite evident from the facts that it would lead to false conclusions if the Quetta death-rate were apparently diminished by distributing its excesses over the improved stations, while at the same time the improvements required at the station would lose their support unless their necessity was shown by the facts.

7. The average annual strength of troops in the Bombay Command (including Quetta) during the year 1884 was 10,794 non-commissioned officers and men, and among these the causes of inefficiency were as follows:—

	Numbers.		Ratio per 1,000.
Admissions - - -	15,178	=	1,415·3
Deaths - - -	204	=	19·02
Constantly sick - - -	694	=	64·70
Invalided for discharge - -	113	=	34·52
Invalided for change - - -	225		

The death-rate of 1884 was 8·65 per 1,000 higher than the rate of 1883, and it exceeded the previous five years' average, which included field service deaths, by 2·43 per 1,000. The admission-rate was, however, 284·6 per 1,000 under the five years' average. The constantly sick was 1·07 per 1,000, and the invaliding 15·58 under the same average. It follows that the great increase in mortality was due to an outbreak of fatal disease somewhere, and we have next to see where this took place, and, as far as possible, to arrive at its causes.

8. We shall first inquire what were the inefficiency rates at the stations in Bombay, apart from the rates already stated which include those for the whole command.

The following are the data, exclusive of Quetta circle and of troops on march, and are those due to the Presidency, Sind, Poona, and Mhow circles, and to the sanitaria:—

Average strength - -	9,074	
Admissions - - -	12,498 = 1377 per 1,000.	
Deaths - - - -	102 = 11·2	„ „

9. These figures include the sanitary data for the Presidency stations properly so called, and we shall next contrast with them the facts regarding Quetta, which are as follows:—

Strength - - - -	1,075	
Admissions - - -	2,151 = 2,000 per 1,000.	
Deaths - - - -	41 = 38·14	„ „

The admission-rate at Quetta was thus about a third greater, and the death-rate about 3½ times greater, than the rates at the older Bombay stations.

10. But the high average death-rate for the whole Command included another element, which is thus described by the Surgeon-General :—"Quetta is the only station in the district in which British "soldiers are quartered, and ordinarily the marches of regiments and battalions to and from Sibi "do not call for remark. Last December was, however, made memorable by a virulent outbreak of "cholera in the 98th Regiment, while quitting the Bolan *en route* to India. The visitation was "short, but very fatal." In the statistical abstract given by the Surgeon-General, the strength of the regiment is given at 577. Its admission-rate at 906·8 per 1,000, and there were 61 deaths, equal to a death-rate of 105·72 per 1,000.

11. In Dr. Stephen's tables the facts are stated as follows :—"Zhob valley expedition and "marching in Southern Afghanistan," and the losses are stated as 39 from cholera, one from enteric and one from intermittent, four from remittent, five from apoplexy, six from respiratory, one from heart disease, and one from some other cause. There were 58 deaths in all, or a death rate of 53·31 per 1,000. This enormous death-rate was incurred in four months. The 58th Regiment appears to have met a cholera epidemic and passed through it on its return to India. The facts appear to be sufficient to justify a separate consideration of the sanitary problem presented by Southern Afghanistan, which, as will be hereafter seen, includes elements differing materially from those presented by Bombay stations generally.

12. We shall next give the chief death causes during 1884, including those at Quetta and on march, as these are stated by Dr. Stephens :—

Diseases.	Admissions per 1,000.	Deaths.	
		Number.	Deaths per 1,000.
Cholera	6·3	52	4·85
Small-pox	·7	1	·09
Enteric fever	·9·1	22	2·05
Intermittent fever	419·7	1	·09
Remittent fever	84·7	43	2·05
Continued fever		2	
Apoplexy, &c.	4·0	16	1·49
Delirium tremens	—	1	·09
Dysentery	26·5	11	1·03
Diarrhœa	53·2	2	·18
Hepatitis	18·9	11	1·03
Respiratory diseases	82·1	15	1·40
Heart disease	—	4	·37
Phthisis pulmonalis	8·1	8	·75
Violent deaths, wounds, &c.	14·6	24	2·24
All other causes	192·1	18	1·68

This abstract includes 208 deaths (or four more than the Surgeon-General's table) of which three deaths appear to have been suicides.

13. We shall next give a brief account of the chief death causes, beginning with cholera. As this abstract shows, there were 52 deaths from this disease; of these, 39 took place among troops on march in Southern Afghanistan, three among troops on march in Bombay Presidency, four at *Deolali* depôt, one at Poona, three at Mhow, one at Nusseerabad, and one at Neemuch. There was no death from cholera at Quetta. The mortality at Bombay stations was only ten; but of these four took place at Deolali depôt, which appears to require looking after, as this is by no means the first experience of the kind. But the cholera epidemic of the year fell on marching regiments, which yielded above four-fifths of the year's mortality.

14. *Enteric Fever.*—The next abstract shows the distribution of this fever in 1884 :—

Stations.	Cases.	Deaths.
Colaba	4	—
Belgaum	4	1
Poona	4	1
Ahmednagar	10	—
Mhow	5	2
Nasirabad	4	1
Neemuch	1	—
Baroda	5	1
Deesa	3	2
Karachi	28	3
Quetta	30	10
Zhob field force	1	—
On march	2	1
Total	98	22

15 The first question raised by these figures is the nature of the cases classed as enteric fever.

It may be admitted that the 22 fatal cases were of enteric fever because of post-mortem diagnosis, but it seems scarcely likely that 10 cases should have occurred at Ahmednagar, all of which recovered. Again, the Karachi cases yielded about one death to nine attacks, while the Quetta cases had a death-rate of one in three. It may be admitted that all the cases were of so severe a character that Medical Officers felt justified in classing them in the way shown in the table; but it seems not unlikely, as stated as his opinion by the Surgeon-General, "that many of those cases were possibly "aggravated forms of continued or remittent fevers, which in their progress assumed typhoid "characters." This view raises again the old question of the nature and relations of enteric fever to common Indian fevers, as will be seen from the following remarks by the Surgeon-General:—"The "typhoid state is a condition which may arise in the course of any febrile disorder when the approach "of death is gradual, and the rise of temperature either excessive or long continued. The typhoid "state is, however, most frequent in typhus, enteric, and yellow fever, and pernicious malarial fevers, "and in such cases the tendency is often evident from the very beginning of the attack." This view would, of course, divest enteric fever of any specific character, and would refer it to the position of a state or aggravation of febrile diseases in which the fatal termination was due to inteslinal lesions usually considered as marking the presence peculiarly of the fever known in our nomenclature as "enteric fever."

16. Our chief interest in the question attaches itself to available means of mitigating or preventing enteric fever attacks, and it seems necessary to state that, without calling in question the passage of Indian fevers into fatal enteric fever, the evidence as it stands appears to us to shew that "enteric "fever" properly so called is the fatal fever of India, and hence we conclude that the discrepancies between the attacks and deaths in the preceding table have been mainly due to defective diagnosis, but, while saying this much, we fully admit the difficulties which arise from the great prevalence of severe forms of malarial fever at Indian stations.

17. The Surgeon-General's remarks are accompanied by opinions of Medical Officers conversant with this fever as it showed itself at different stations which may be noticed. One of these, which the Surgeon-General says "was presumably formulated after patient observation of those cases which "did occur at Quetta last year," is that the disease is a "fecal" fever, which may be due to the gross habits of feeding of British soldiers in unaccustomed climates, where abnormal chills may cause internal congestions and disturbance of the whole digestive functions, of which enteric fever is the result, rather than to external causes, such as drainage defects.

Another medical officer, late of Quetta district, states that, "were it not for the frequent distinctly "tertian, quartan, and other remissions, and the non-progressive rise of temperature (in some cases) "from day to day, we should deem it absolutely identical with European typhoid. It is strongly "modified by, if it be not perhaps connected with, malaria, in the relation of effect and cause." Neither of these views, however, alters the fact that the fatal cases at Quetta were of enteric fever. No questions are raised at the Bombay stations as to the nature of the fever which is accepted as being "enteric fever."

18. Taking the data of 1884 as they stand, the Surgeon-General states his own opinion in the following words:—"1st. There is a form of fever called enteric fever which is not that disease "*proper*, but which is due to malaria, and presents great difficulties in diagnosis from true enteric "fever. 2nd. We have pure enteric fever, which I believe might almost invariably be traced to pre-"existing causes if our information were complete." As this view has a somewhat important bearing on sanitary work, it is necessary to state here that there is a very important difference, practically, between an ascertained fact and an unproved opinion, of which latter no account can be taken, especially where money has to be spent.

19. We shall next notice briefly the information in the Report on the presumed causes of enteric fever, and first as to the influence of age, which is shown year by year in a special table. It will, however, be sufficient for our purpose to give this in abstract, as follows:—

Ages.	Cases.	Deaths.
Under 25	79	18
Above 25	19	4
Total	98	22

So far as age is concerned in its relation to fever predisposition, this abstract shows the facts and their cause, while it suggests the remedy.

20. The effect of length of service is shown year by year in the same table, and the following results are abstracted from it:—

Length of Service.	Cases.	Deaths.
Under 3 years	79	17
Above 3 years	19	5
Total	98	22

There is nothing in either abstract that has not been long known, and together they affirmanew the principle that young ages and short service tend to keep up the death-rate from enteric fever, apart from all other predisposing causes.

21. But, as the next abstract shows, season has also a very material influence on the prevalence of fever :—

Months, 1882.	Enteric fever.	
	Admissions.	Deaths.
January	1	1
February	6	—
March	7	—
April	7	3
May	7	4
June	6	1
July	8	1
August	13	2
September	25	5
October	10	3
November	4	1
December	4	1
Total	98	22

It hence appears that the largest number of cases and deaths took place in the autumn months, but the absence of deaths in the first three months, with one solitary exception in January, confirms the view that cases of other fever types were included under enteric fever in these months, as well as during the autumn months, when 48 fever cases yielded only 10 deaths.

Where local causes are mentioned, they are of the following character.

22. *Karachi*.—At this station there were 28 cases and three deaths of enteric fever, and the Report states that "no cause for the prevalence of enteric fever can be found in the sanitary condition of the "barracks and their surroundings, for these are stated to be good." But it is admitted that the history of fever in regiments "bespeaks a grave sanitary defect somewhere." The Deputy Surgeon-General is of opinion that the disease is endemic at Karachi, and he advises that newly arrived regiments should never be placed in garrison at Karachi if it can be avoided. That there is a cause for all this does not admit of a doubt, but it does not follow that the cause is in the station itself. We have more than once called attention to the malaria, which in all probability proceeds from the back-water, and, in certain states of the wind this would easily reach the station and produce its characteristic effects there, and it was on this account chiefly that we advised formerly the removal of troops to Ghizri. There is a fact stated in the present Report which appears to confirm the view of this malaria being air-borne.

The barracks are in two stories, and out of 27 cases of fever 5 were received from the lower floors, and 22 from the upper floors of the blocks, clearly showing that the fever cause was more active in the upper floors, which could not be affected by the state of the subsoil; of course, without some local inquiry, this is only conjecture, but if there be air-borne malaria from the backwater it would be more likely to injure the men most exposed to its influence.

The practical result of this, as of previous discussions, is that it would be the cheapest way out of the difficulty to go to Ghizri, or at all events to give the proposal a fair trial.

23. Fever at *Ahmednagar* is attributed to impure water used for making ginger-beer, and also to impure bazaar milk, in which micro-organisms were found. Both causes come under local administration, and should be so dealt with.

24. At *Mhow* "no cause has been assigned for the outbreak by any Medical Officer." On the importation theory it is supposed that the Mhow cases were due to a gunner who had arrived at Mhow from Neemuch 21 days before his admission to hospital. But there was no enteric fever at Neemuch at the time to carry away, and the mere succession of cases at Mhow is assumed as evidence of cause and effect. The two first cases, both of which proved fatal, were admitted on the 21st and 29th April. The consecutive dates of the four cases which recovered were 6th June, 29th July, 15th August, and 25th October. There is no evidence whatever of causative relation between the cases, and it does not tend to increase our knowledge to plead the difficulties of inquiries. In practical sanitary work a fact is a fact or it is nothing.

25. At *Poona* there were six cases of enteric fever, of which one died. "No cause is assigned for the occurrence of the disease at this station."

The same remark is made regarding the three cases at *Deesa*.

26. One of the four *Nasirabad* cases is attributed to casual drinking of impure water, and others to a foul temple since destroyed.

No cause is assigned for the two cases at *Neemuch*.

A similar remark applies to the other local outbreaks.

We shall discuss the Quetta cases by themselves.

27. *Venereal diseases.*—The following admissions from these diseases were recorded in 1884:—

Primary syphilis	966 =	90·1 per 1,000.	
Secondary	204 =	19·0	„
Gonorrhœa	1,302 =	121·4	„
Sequelæ of ditto	289 =	26·9	„
	2,761 =	257·4	

As will be seen, the ratio of admissions under this head was high, and somewhat diminishes the hopes which of late years have been entertained regarding improvements by the agency of lock hospitals and police.

The admissions at Poona averaged 211 per 1,000, which is considered to be not an unfavourable result, due in part to what we long ago emphatically condemned, namely, that European soldiers were employed "to control prostitution."

So far as relates to the stations within the Presidency there is nothing further in the disease history of 1884 which calls for remark, and we shall next give a brief account of the sanitary condition and improvement in these stations during the year.

28. The first point of importance is the provision at present made for cases of infectious disease, especially among children landed at Colaba from the troopships. Properly speaking, there is none, but we learn that suitable provision will be made for this purpose in the new barrack project, but until this is completed there will be periodical need, and for meeting this a sufficiency of tent accommodation on healthy ground will be required; and it ought to be immediately available. A wooden hut or two would be better.

29. *Ghorpuri Barracks, Poona.*—The site of the new barracks was condemned before they were built. They had to be vacated on account of fever; after a time they were re-occupied, and at the end of June 1885 troops were removed again "owing to the excessive prevalence of "levers." We have never been informed how it was they came to be built in the face of the Report of the Sanitary Commissioner against the site.

30. At *Kirkee* it is proposed to collect the cook-house and wash-house water into stone tanks, whence it will be removed by hand, and the reason assigned for this proceeding is instructive. It is to avoid swampy ground "in the vicinity of the buildings from the overflowing of the present "receptacles, which are neither numerous enough nor of sufficient capacity." Of course swampy ground near or within a cantonment means fever.

In one barrack at this station another plan has been tried. So far as we understood it an area of ground sufficient to use up this drainage water is enclosed and prepared to a depth of 3½ feet. It is then traversed by porous pipes and filled up to the level with the usual soil. Water from cook-houses and wash-houses is conducted to the pipes by a drain, and thus is distributed to the soil, which is planted with Haryali grass, and so the drainage water is disposed of. The pit is 10 yards from the barrack, and is intended to be of sufficient size to dispose of the drainage water of the block. It had apparently answered for three months, but the rains had yet to try it. The case is one of drainage of separate buildings each by itself, and the disposal of the water for agriculture. A general system and one general application of the waste water would probably be both safer and cheaper, especially if the enclosed areas became swampy at the end of the rainy season. We must wait the result.

31. A necessary part of all buildings in which health and economy are deemed to be worth caring for is provision of gutters for removing roof-water. At Ahmednagar the Deputy Surgeon-General says that the Artillery barracks have gutters; but as regards the others, he very properly remarks that "the expense incurred in making improvements in this respect would be small compared with the "gain in health to the men and the diminished deterioration of buildings." The real wonder is why the barracks were left incomplete, and yet the local authorities say that it is not urgently required. If so, why were the Artillery barracks completed?

32. Here is another case at a sanatorium. The Medical Officer reports in regard to Purandhur, that "the surface drainage around the various buildings leaves much to be desired. There are "neither gutters under the eaves to receive the rain-water, nor (with one or two exceptions) are "there any drains round the buildings to carry it off, and to prevent it soaking in under the "building and appearing as moisture on the stone floors." The case of the female hospital is so bad from this cause that the executive engineer could suggest no remedy except that "hospital guard-room should be used as a hospital "for females during the monsoon." What can be said of this?

33. *Mhow.*—We are glad to learn that "the swamp near the Infantry barracks, noted in the "Report for 1883, has been efficiently drained," and that roof gutters and pipes have been put up at one barrack, to remove rain-water to a distance. One well has been deepened, permanently covered in, and the water is lifted by a force pump to an elevated tank and filtered for barrack use.

We have mentioned already that at Karachi the upper stories of barracks yielded more fever than the lower, showing that in all probability the fever cause was not in the subsoil so much as at a distance.

At Mhow, the Infantry, which is chiefly quartered in upper storied barracks, yield nearly four times as much "sickness" as the singled storied buildings. The exact diseases, and the proportion in upper storied rooms, are not given. But it is stated that the cases of fevers were "admitted "mainly from those buildings which the Sanitary Commissioner noted as being especially affected by "damp during the monsoon." And No. 4 Infantry barracks, in the neighbourhood of which there is defective surface and subsoil drainage, yielded nine fever cases. The relation of upper story rooms to fever requires elucidation, because it is possible, as has been already hinted, that the cause may be greater exposure to distant malaria sources.

34. *Nasirabad.*—The waste water from the ablution rooms is now passed into receptacles and carried away twice daily. New filter beds and a storage tank have been constructed in connexion with the Dánta water-supply. The death-rate at this station was augmented by a lightning stroke by which six deaths took place.

35. *Baroda.*—This unhealthy station, in which were well known sanitary defects in surface and subsoil drainage and in the state of the buildings, was, we are glad to say, completely vacated on the 1st October 1884. This, it will be seen, is the second group of barracks which it has been necessary to vacate in the course of the year because of obvious disease causes which, under a sound sanitary executive, ought not to have existed.

36. In the preceding paragraphs we have touched upon the chief points requiring notice in which general sanitary principles are involved, but there are a number of matters of detail in the stational reports which the authorities have every disposition to attend to as far as means are at their disposal.

37. Still limiting our remarks to the Presidency stations, there is evidence in the Report under review that the chief elements in the sanitary state of the stations are becoming better understood, and their importance to the health of troops duly appreciated. Much good work has been done with a corresponding saving of life and efficiency which is not shown in the statistics, because data are included which belong to the Command as a whole, and the data regarding Quetta and the troops on march in Southern Afghanistan have to be discussed for practical purposes as a separate problem, and we shall now see what light is thrown on the high death-rates there by the information in the present Report.

38. *Quetta.*—During the ten years 1874 to 1883 the average annual admissions at this station were 941·8 per 1,000, and the annual deaths 13·17 per 1,000, neither of them very high. But in 1884, out of a strength of 1,075, the admission-rate was 2,000·9 per 1,000, and the death rate 38·14 per 1,000, and there was not a single case or death from cholera.

The principal fatal diseases were the following:—

Enteric fever, 30 cases, 10 deaths.
Paroxysmal fever, 544 cases, 6 deaths.
Other fevers, 283 cases.
Tubercular diseases, 5 cases, 2 deaths.
Respiratory, 82 cases, 4 deaths.
Digestive, 523 cases, 11 deaths.

Of the last group 90 cases and 6 deaths were due to dysentery, 157 cases to diarrhœa, and 15 cases and 2 deaths to hepatitis, &c. The febrile group, together with those diseases of the digestive group that are usually associated with local and climatic causes, yield the data for the Quetta sanitary problem, at least for 1884, but we cannot overlook the fact that in the same region and in the space of four months 1,088 men on the march lost 39 men from cholera, so that in 1884 this epidemic, but for reasons unknown, might have fallen on Quetta also.

39. In dealing with the health conditions of Quetta, the first paragraph in the Medical Officer's report relates to the climate; the elements of which are contained in the following abstract from Mr. Blanford's Meteorology of India for the year 1883:—

Temperature and Rainfall.

Months.	Mean.	10 hours.	22 hours.	Mean of Maxima.	Mean daily range.	Mean of Minima.	Highest Maximum. Day.	Highest Maximum. °	Absolute Range.	Lowest Minimum. Day.	Lowest Minimum. °	Rainfall, 6 years' average.
January	37·6	49·5	44·2	67·8	27·5	30·3	4th	69·8	35·3	31st	12·8	0·94
February	38·2	49·5	46·3	69·6	29·4	30·2*	28th	69·8	39·7	1st	15·3	1·67
March	46·4	54·4	52·9	81·3	32·5	38·6	29th	73·9	44·4	5th	26·2	2·98
April	56·9	66·3	74·9	74·1	29·3	46·8	13th	92·8	45·6	2nd & 4th	39·0	0·94
May	67·2	76·3	80·71	88·79	28·1	55·97	31st	90·7	46·4	13th	46·3	0·31
June	76·1	86·3	90·4	98·3	32·3	61·5	27th	102·3	51·5	23th	50·6	0·17
July	76·3	83·5	87·2	91·3	25·9	65·43	7th	99·4	45·3	22nd	56·1	1·00
August	75·0	84·4	89·7	92·5	32·3	60·2	4th	96·3	42·4	24th	53·9	0·57
September	68·4	78·22	85·35	86·95	35·4	51·51	2nd	92·2	51·3	24th	40·4	0·21
October	54·8	64·7	70·9	73·5	34·9	38·6	2nd	83·8	38·9	20th	33·9	—
November	43·9	51·9	57·6	60·1	29·9	30·2	5th	73·3	34·0	30th	19·4	—
December	40·9	44·7	52·6	55·4	29·2	29·2	26th	64·9	46·6	31st	16·3	0·53
Year	57·4	64·5	69·9	79·7	27·8	44·6	—	102·3	37·2	—	15·1	8·96

* Mean of 27 days.
† Mean of 30 days.
‡ Mean of 26 days.
§ Mean of 22 days.

This table shows clearly what the character of the climate is, and its sensible qualities are described by the Medical Officer as follows:—"As to the climate ordinarily, that of Quetta is, owing

"to the 5,500 feet of elevation of the station, much milder during the summer than in Sind "or the Punjab, but in winter it is very cold, and in autumn the temperature variations are quick "and great."

40. The mean annual rainfall is only 8·24 inches, and above one half of the fall takes place in December, January, February, and March, that is, in the cold months. In this point the climate differs essentially from Indian climates. It is a climate of dry air, terrestrial radiation, and cold, and, if it can be said of any eastern climate that the elements usually productive of malaria are absent, this is the case at Quetta. The temperature variations are very remarkable. The table shows a difference of no less than 87·2° between the highest and lowest temperatures of the year, and the monthly ranges point to extreme day ranges also. For six months of the year the minimum temperatures are very low for the latitude, and the mean daily range is very considerable even during the hottest months, showing that at times the daily range must be great.

41. Absence of general malaria sources has not been attended by absence of malarial fever, for out of 876 admissions from the febrile group 544 were cases of paroxysmal fevers. But this is no new experience, for in past years there have been sudden outbreaks even among Native troops of ague disease.

42. When discussing this question formerly, we felt disposed to rank these fevers not as of primary malarial origin so much as being the result of resuscitated fever attacks originally contracted in the plains of India, and in the cases alluded to there was evidence to show that men had been stationed at Quetta without the modifications in clothing, shelter, &c., demanded by the peculiarities of the climate.

In clothing some improvement has taken place since then, and of clothing and bedding it is stated that "both appeared to be sufficient at all times, being lightened or increased as the seasons or "particular duties suggested," but then it is stated that "the uniform *clothing* was sufficient, and was "in winter supplemented by warm garments provided for men on night guards." The question naturally suggests itself here, What is meant by "uniform clothing?" Is it the uniform the men had previously worn at Indian stations, or is it a special Quetta uniform? If the former, then the meteorological table already given shows that it would not be sufficient to protect the men from the great difference between the climate of Quetta and the climates of India, apart altogether from the great temperature variations. We merely suggest the question for inquiry, because in the face of the disease statistics it requires an answer.

43. Next, as regards the accommodation for troops, we have the following statement:—"As to "shelter, it consisted in Quetta of newly built barracks of light structure, and of small, low-ceilinged, "dark, and dusty mud huts, plagued with flies in hot weather, and very difficult to warm in winter. "The hospital huts are scarcely better than the worst barrack huts in any respect."

44. These huts will be given up as soon as better accommodation is provided, but we may suggest that the class of barrack most suited for Indian stations on the hot sultry plains, little elevated above sea level, are not suited for climates such as that of Quetta, at an elevation of 5,500 feet above the sea, and we are told that in the new barracks already built "the fire-places are so placed and designed "that a proper radiation of heat fails to occur. The ventilation of the new barracks is rather "excessive, but will be made controllable, I believe."

45. The site of the station itself is not favourable, and requires to be fully taken into account in providing barrack accommodation. It is described as follows:—"The Quetta valley is overlaid by "dense clay, very stony where uncultivated, and the ground is formed into an endless series of "degrees of slope, all converging to the Shál Lora. So great are the inclines in the station itself "that to any one standing near a new barrack the old barracks and officers huts are much below the "line of sight. Hence rain-water runs off quickly, aided by an embankment on the east and broad "shallow channels dug for the purpose. The clay quickly dries, and percolation is apparently "small."

46. The remark suggested by this topographical statement is that every barrack room and sick ward and every quarter ought to be completely isolated from the slope above the site it occupies by a broad, open, clear, and well drained space.

Drinking water is provided from a guarded spring, and filtered before use.

We have made these remarks on the points in the Quetta Report as stated by the Medical Officers. But it is also stated that a special report had been made on the whole subject by the Sanitary Commissioners. This report is not among the papers. But there is sufficient in the Surgeon General's report to show not only the nature of this Quetta problem, but to prove at the same time that it requires separate consideration and separate treatment in some respects from that needed for Indian stations generally, and this is all the more important because there is a prospect of a large additional force being stationed in the country.

47. As regards the Bombay question generally, and apart from Quetta, the statistics show the result of good work done, but they also show the need of watchfulness, in order that the ground already gained may be kept, and the Report, as a whole, contains much useful sanitary information.

8th June 1886.

No. 16.

MEMORANDUM of the ARMY SANITARY COMMISSION on REPORTS on FAIRS and FESTIVALS held in the MADRAS PRESIDENCY during the latter months of 1883 and part of 1884 (Supplementary to No. 17, p. 251, Vol. xvii).

1. There are 22 registration districts in Madras Presidency from which returns of deaths from cholera were made in 1884. In 17 of these districts fairs and festivals were held in 1884. The facts regarding these are given in the Reports under review, but they also include 14 fairs held in 1883, which it is necessary to separate from those of the subsequent year in order to be able to compare the death-rates of the fairs of 1884 with the district rates of the same year.

2. Of the fairs held in 1883, one at Mayavaram, in Tanjore, had four deaths from cholera in November, and another at Tirupati, in North Arcot, held in October had six deaths.

3. Leaving these aside, the data in the Reports will stand as follows:—

Total number of festivals reported in the papers	147
Number held in 1883	14
Festivals held in 1884	133

4. Out of the total number of festivals deaths from cholera were returned from six, and non-fatal cases from one, so that seven were attacked; but, as has been just stated, two of the fairs at which deaths took place were held in 1883, and the fair where non-fatal cases were reported was also held in 1883. It follows that, of the 1884 festivals, four only yielded cholera deaths.

5. The total deaths reported for both years were 37, but as 10 of these deaths took place in 1883, we have to account for 27 deaths.

6. The data for 1884 thus stand as follows:—

Districts where fairs and festivals we held in 1884	17
Number of fairs and festivals	133
Number of these at which cholera appeared	4
Deaths at these four festivals	27

7. One important element in the question is unfortunately incomplete. We have not the numbers which attended the fairs in all cases. Only 77 out of 133 have made such returns, amounting in all to 1,114,200. If we assume the attendance at all the fairs to have been on a similar scale, we should have a population of about two millions as that which yielded the 27 deaths from cholera or about 0·013 per 1,000.

8. We can scarcely compare the nearly complete exemption of these temporary festivals with the year's death-rate for Madras Presidency, which was 2·7 per 1,000; but we can place side by side the district cholera deaths with the results of the festivals as follows:—

Districts.	Deaths from Cholera in 1884.	Number of Fairs in 1884.	Deaths from Cholera in 1884.	Names of Fairs attacked or where held.
Tanjore	23,671	13	11	Velanganny, in Tranquebar.
Malabar	337	8		
South Canara	None	2		
South Arcot	3,069	3	7	Chidambaram.
North Arcot	3,179	4		
Trichinopoly	4,517	1	4	Sriringham.
Bellary	1,068	4		
Salem	2,265	27		
Kistna	1,561	6		
Cuddapah	575	6		
Ganjam	172	3		
Godaveri	855	5		
Anantapur	239	4		
Madura	4,613	34		
Tinivelly	16,445	5	5	Srivilliputar.
Vizagapatam	14	2		
Chingleput	2,848	1		
Total in 17 districts	76,368	133	27	4

9. The statistical facts regarding the year's experience of these fairs may be summed up as follows:—The total deaths from cholera in Madras Presidency in 1884 were 75,476. Fairs and festivals were held in 17 districts out of 22. Deaths from cholera in these 17 districts were 70,368. In the course of the year 133 fairs and festivals were held, at which some two millions of people were present. Of these fairs cholera appeared at four, and the total mortality was 27 deaths, or in the approximate ratio of 0·013 per 1,000 of the total attendants.

10. The greatest mortality took place at one fair held in Tanjore district, where the epidemic was very severe, and the district death-rate 11·1 per 1,000, the highest of the year. In South Arcot, where one festival yielded seven deaths, the district death-rate was 4·4 per 1,000. The four deaths at Sriringham, in Trichinopoly, were part of a local epidemic which caused 20 deaths in the town, and the district death-rate was 3·7 per 1,000. Tinivelly death-rate was 9·6 per 1,000 for the district, and the five festival deaths were part of the epidemic. With the single exception of Madura district, which had a death-rate of 3·5 per 1·000, and no cholera at its 34 fairs, it may be stated that where the district death-rates were highest there was most risk from cholera at the fairs.

11. On one important branch of this inquiry the information is incomplete, namely, on the kind of sanitary measures which were adopted to preserve health during the fairs. In some cases, where these assemblages were held at or near small villages, no special precautions were taken. The villagers with their headmen attended to the work, which in such examples was perhaps the best way of having it done. In other cases nothing was done, but in 116 cases opinions on the sufficiency or insufficiency of the measures are expressed, often by Native officials. In 99 instances the precautions adopted are stated to have been "sufficient," and in 17 "insufficient." The principal means of preservation was cleansing sometimes by additional workers, and protection of water-sources. Several cases are given in which cholera was present in towns and villages where fairs were held without any of the pilgrims or other attendants having been attacked.

12. In the preceding table we have given the names of festivals where cholera appeared. At one of these, Velanganny, there were 11 deaths. There were about 15,000 people present, and the sanitary measures adopted are stated to have been "insufficient."

At Chidabaram, in South Arcot, where 5,000 people were assembled, the measures adopted were "unsatisfactory" and seven attendants died of cholera.

At Sriringham, in Trichinopoly, there were four deaths at the festival, and 20 in the town, not caused by it. The measures adopted were considered "satisfactory."

At Srivilliputur, in Tinivelly, there were assembled 15,000 people and 2,500 cattle. The only measure stated to have been adopted was providing latrines. At this fair there were five deaths from cholera, which, moreover, prevailed in the vicinity.

13. The following instance may be cited as one of notable exemption. Madura district had 4,613 deaths from cholera, and in this district Chittrai fair was held, at which there were present 150,000 people and 22,306 cattle. Sanitary measures stated to have been "sufficient" were adopted, and there was no cholera.

As a general rule, sanitary work was carried out at the fairs where there was no cholera.

14. The experience as a whole confirms that of former years, and shows that in the midst of severe district epidemics it is possible to obtain comparative immunity from cholera by precautions of a very simple and inexpensive kind. Cleanliness, prevention of nuisances and overcrowding, and keeping water-sources free from pollution, afford sufficient protection for people who have vacated their unwholesome villages and houses for a time. They are the same measures we have again and again advised for villages, and are stated in detail in our "Suggestions." Past experience justifies us in advising their continuance and improvement, and that the annual reports should enter more into detail, showing the actual sanitary condition of the localities, the numbers present, and the detailed precautions which were in force, as well as the results to health.

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